LINCOLN ELECTRIC

GENUINE LINCOLN PARTS™

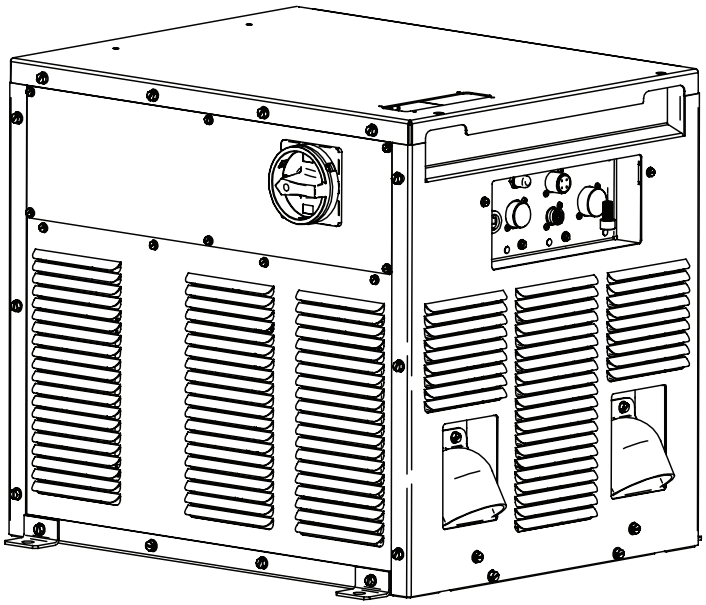
NOTE: This manual will cover most of the troubleshooting and repair procedures for the code numbers listed. Some variances may exist when troubleshooting/repairing later code numbers.

POWER WAVE® i400

For use with machines having Code Numbers:

11454, 11454R, 11536, 11536R, 11945, 11774, 11775

SERVICE MANUAL



SVM190-A | Issue Date 12-Oct

THE LINCOLN ELECTRIC COMPANY
22801 St. Clair Avenue • Cleveland, OH • 44117-1199 • U.S.A.
Phone: +1.216.481.8100 • www.lincolnelectric.com

Return to Master TOC
Return to Master TOC
Return to Master TOC
Return to Master TOC

⚠ WARNING

⚠ CALIFORNIA PROPOSITION 65 WARNINGS ⚠

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

The Above For Diesel Engines

The engine exhaust from this product contains chemicals known to the State of California to cause cancer, birth defects, or other reproductive harm.

The Above For Gasoline Engines

ARC WELDING can be hazardous. PROTECT YOURSELF AND OTHERS FROM POSSIBLE SERIOUS INJURY OR DEATH. KEEP CHILDREN AWAY. PACEMAKER WEARERS SHOULD CONSULT WITH THEIR DOCTOR BEFORE OPERATING.

Read and understand the following safety highlights. For additional safety information, it is strongly recommended that you purchase a copy of "Safety in Welding & Cutting - ANSI Standard Z49.1" from the American Welding Society, P.O. Box 351040, Miami, Florida 33135 or CSA Standard W117.2-1974. A Free copy of "Arc Welding Safety" booklet E205 is available from the Lincoln Electric Company, 22801 St. Clair Avenue, Cleveland, Ohio 44117-1199.

BE SURE THAT ALL INSTALLATION, OPERATION, MAINTENANCE AND REPAIR PROCEDURES ARE PERFORMED ONLY BY QUALIFIED INDIVIDUALS.

FOR ENGINE powered equipment.

1.a. Turn the engine off before troubleshooting and maintenance work unless the maintenance work requires it to be running.

1.b. Operate engines in open, well-ventilated areas or vent the engine exhaust fumes outdoors.

1.c. Do not add the fuel near an open flame welding arc or when the engine is running. Stop the engine and allow it to cool before refueling to prevent spilled fuel from vaporizing on contact with hot engine parts and igniting. Do not spill fuel when filling tank. If fuel is spilled, wipe it up and do not start engine until fumes have been eliminated.

1.d. Keep all equipment safety guards, covers and devices in position and in good repair.Keep hands, hair, clothing and tools away from V-belts, gears, fans and all other moving parts when starting, operating or repairing equipment.

1.e. In some cases it may be necessary to remove safety guards to perform required maintenance. Remove guards only when necessary and replace them when the maintenance requiring their removal is complete. Always use the greatest care when working near moving parts.

1.f. Do not put your hands near the engine fan. Do not attempt to override the governor or idler by pushing on the throttle control rods while the engine is running.

1.g. To prevent accidentally starting gasoline engines while turning the engine or welding generator during maintenance work, disconnect the spark plug wires, distributor cap or magneto wire as appropriate.

1.h. To avoid scalding, do not remove the radiator pressure cap when the engine is hot.

ELECTRIC AND MAGNETIC FIELDS may be dangerous

2.a. Electric current flowing through any conductor causes localized Electric and Magnetic Fields (EMF). Welding current creates EMF fields around welding cables and welding machines

2.b. EMF fields may interfere with some pacemakers, and welders having a pacemaker should consult their physician before welding.

2.c. Exposure to EMF fields in welding may have other health effects which are now not known.

2.d. All welders should use the following procedures in order to minimize exposure to EMF fields from the welding circuit:

2.d.1. Route the electrode and work cables together - Secure them with tape when possible.

2.d.2. Never coil the electrode lead around your body.

2.d.3. Do not place your body between the electrode and work cables. If the electrode cable is on your right side, the work cable should also be on your right side.

2.d.4. Connect the work cable to the workpiece as close as possible to the area being welded.

2.d.5. Do not work next to welding power source.

Return to Master TOC
Return to Master TOC
Return to Master TOC
Return to Master TOC

ELECTRIC SHOCK can kill.

3.a. The electrode and work (or ground) circuits are electrically "hot" when the welder is on. Do not touch these "hot" parts with your bare skin or wet clothing. Wear dry, hole-free gloves to insulate hands.

3.b. Insulate yourself from work and ground using dry insulation. Make certain the insulation is large enough to cover your full area of physical contact with work and ground.

In addition to the normal safety precautions, if welding must be performed under electrically hazardous conditions (in damp locations or while wearing wet clothing; on metal structures such as floors, gratings or scaffolds; when in cramped positions such as sitting, kneeling or lying, if there is a high risk of unavoidable or accidental contact with the workpiece or ground) use the following equipment:

- **Semiautomatic DC Constant Voltage (Wire) Welder.**
- **DC Manual (Stick) Welder.**
- **AC Welder with Reduced Voltage Control.**

3.c. In semiautomatic or automatic wire welding, the electrode, electrode reel, welding head, nozzle or semiautomatic welding gun are also electrically "hot".

3.d. Always be sure the work cable makes a good electrical connection with the metal being welded. The connection should be as close as possible to the area being welded.

3.e. Ground the work or metal to be welded to a good electrical (earth) ground.

3.f. Maintain the electrode holder, work clamp, welding cable and welding machine in good, safe operating condition. Replace damaged insulation.

3.g. Never dip the electrode in water for cooling.

3.h. Never simultaneously touch electrically "hot" parts of electrode holders connected to two welders because voltage between the two can be the total of the open circuit voltage of both welders.

3.i. When working above floor level, use a safety belt to protect yourself from a fall should you get a shock.

3.j. Also see Items 6.c. and 8.

ARC RAYS can burn.

4.a. Use a shield with the proper filter and cover plates to protect your eyes from sparks and the rays of the arc when welding or observing open arc welding. Headshield and filter lens should conform to ANSI Z87. I standards.

4.b. Use suitable clothing made from durable flame-resistant material to protect your skin and that of your helpers from the arc rays.

4.c. Protect other nearby personnel with suitable, non-flammable screening and/or warn them not to watch the arc nor expose themselves to the arc rays or to hot spatter or metal.

FUMES AND GASES can be dangerous.

5.a. Welding may produce fumes and gases hazardous to health. Avoid breathing these fumes and gases.When welding, keep your head out of the fume. Use enough ventilation and/or exhaust at the arc to keep fumes and gases away from the breathing zone. **When welding with electrodes which require special ventilation such as stainless or hard facing (see instructions on container or MSDS) or on lead or cadmium plated steel and other metals or coatings which produce highly toxic fumes, keep exposure as low as possible and within applicable OSHA PEL and ACGIH TLV limits using local exhaust or mechanical ventilation. In confined spaces or in some circumstances, outdoors, a respirator may be required. Additional precautions are also required when welding on galvanized steel.**

5. b. The operation of welding fume control equipment is affected by various factors including proper use and positioning of the equipment, maintenance of the equipment and the specific welding procedure and application involved. Worker exposure level should be checked upon installation and periodically thereafter to be certain it is within applicable OSHA PEL and ACGIH TLV limits.

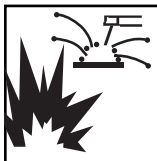
5.c. Do not weld in locations near chlorinated hydrocarbon vapors coming from degreasing, cleaning or spraying operations. The heat and rays of the arc can react with solvent vapors to form phosgene, a highly toxic gas, and other irritating products.

5.d. Shielding gases used for arc welding can displace air and cause injury or death. Always use enough ventilation, especially in confined areas, to insure breathing air is safe.

5.e. Read and understand the manufacturer's instructions for this equipment and the consumables to be used, including the material safety data sheet (MSDS) and follow your employer's safety practices. MSDS forms are available from your welding distributor or from the manufacturer.

5.f. Also see item 1.b.

Return to Master TOC
Return to Master TOC
Return to Master TOC
Return to Master TOC



WELDING and CUTTING SPARKS can cause fire or explosion.

6.a. Remove fire hazards from the welding area.If this is not possible, cover them to prevent the welding sparks from starting a fire. Remember that welding sparks and hot materials from welding can easily go through small cracks and openings to adjcent areas. Avoid welding near hydraulic lines. Have a fire extinguisher readily available.

6.b. Where compressed gases are to be used at the job site, special precautions should be used to prevent hazardous situations. Refer to “Safety in Welding and Cutting” (ANSI Standard Z49.1) and the operating information for the equipment being used.

6.c. When not welding, make certain no part of the electrode circuit is touching the work or ground. Accidental contact can cause overheating and create a fire hazard.

6.d. Do not heat, cut or weld tanks, drums or containers until the proper steps have been taken to insure that such procedures will not cause flammable or toxic vapors from substances inside. They can cause an explosion even though they have been “cleaned”. For information, purchase “Recommended Safe Practices for the Preparation for Welding and Cutting of Containers and Piping That Have Held Hazardous Substances”, AWS F4.1 from the American Welding Society (see address above).

6.e. Vent hollow castings or containers before heating, cutting or welding. They may explode.

6.f. Sparks and spatter are thrown from the welding arc. Wear oil free protective garments such as leather gloves, heavy shirt, cuffless trousers, high shoes and a cap over your hair. Wear ear plugs when welding out of position or in confined places. Always wear safety glasses with side shields when in a welding area.

6.g. Connect the work cable to the work as close to the welding area as practical. Work cables connected to the building framework or other locations away from the welding area increase the possibility of the welding current passing through lifting chains, crane cables or other alternate circuits. This can create fire hazards or overheat lifting chains or cables until they fail.

6.h. Also see item 1.c.

6.I. Read and follow NFPA 51B “ Standard for Fire Prevention During Welding, Cutting and Other Hot Work”, available from NFPA, 1 Batterymarch Park,PO box 9101, Quincy, Ma 022690-9101.

6.j. Do not use a welding power source for pipe thawing.

CYLINDER may explode if damaged.

7.a. Use only compressed gas cylinders containing the correct shielding gas for the process used and properly operating regulators designed for the gas and pressure used. All hoses, fittings, etc. should be suitable for the application and maintained in good condition.

7.b. Always keep cylinders in an upright position securely chained to an undercarriage or fixed support.

7.c. Cylinders should be located:

- Away from areas where they may be struck or subjected to physical damage.
- A safe distance from arc welding or cutting operations and any other source of heat, sparks, or flame.

7.d. Never allow the electrode, electrode holder or any other electrically “hot” parts to touch a cylinder.

7.e. Keep your head and face away from the cylinder valve outlet when opening the cylinder valve.

7.f. Valve protection caps should always be in place and hand tight except when the cylinder is in use or connected for use.

7.g. Read and follow the instructions on compressed gas cylinders, associated equipment, and CGA publication P-I, “Precautions for Safe Handling of Compressed Gases in Cylinders,” available from the Compressed Gas Association 1235 Jefferson Davis Highway, Arlington, VA 22202.

FOR ELECTRICALLY powered equipment.

8.a. Turn off input power using the disconnect switch at the fuse box before working on the equipment.

8.b. Install equipment in accordance with the U.S. National Electrical Code, all local codes and the manufacturer’s recommendations.

8.c. Ground the equipment in accordance with the U.S. National Electrical Code and the manufacturer’s recommendations.

Refer to **http://www.lincolnelectric.com/safety** for additional safety information.

Return to Master TOC
Return to Master TOC
Return to Master TOC
Return to Master TOC

PRÉCAUTIONS DE SÛRETÉ

Pour votre propre protection lire et observer toutes les instructions et les précautions de sûreté specifiques qui parraissent dans ce manuel aussi bien que les précautions de sûreté générales suivantes:

Sûreté Pour Soudage A L'Arc

1. Protegez-vous contre la secousse électrique:

   a. Les circuits à l'électrode et à la piéce sont sous tension quand la machine à souder est en marche. Eviter toujours tout contact entre les parties sous tension et la peau nue ou les vétements mouillés. Porter des gants secs et sans trous pour isoler les mains.
   b. Faire trés attention de bien s'isoler de la masse quand on soude dans des endroits humides, ou sur un plancher metallique ou des grilles metalliques, principalement dans les positions assis ou couché pour lesquelles une grande partie du corps peut être en contact avec la masse.
   c. Maintenir le porte-électrode, la pince de masse, le câble de soudage et la machine à souder en bon et sûr état defonctionnement.
   d.Ne jamais plonger le porte-électrode dans l'eau pour le refroidir.
   e. Ne jamais toucher simultanément les parties sous tension des porte-électrodes connectés à deux machines à souder parce que la tension entre les deux pinces peut être le total de la tension à vide des deux machines.
   f. Si on utilise la machine à souder comme une source de courant pour soudage semi-automatique, ces precautions pour le porte-électrode s'applicuent aussi au pistolet de soudage.

2. Dans le cas de travail au dessus du niveau du sol, se protéger contre les chutes dans le cas ou on recoit un choc. Ne jamais enrouler le câble-électrode autour de n'importe quelle partie du corps.

3. Un coup d'arc peut être plus sévère qu'un coup de soliel, donc:

   a. Utiliser un bon masque avec un verre filtrant approprié ainsi qu'un verre blanc afin de se protéger les yeux du rayonnement de l'arc et des projections quand on soude ou quand on regarde l'arc.
   b. Porter des vêtements convenables afin de protéger la peau de soudeur et des aides contre le rayonnement de l'arc.
   c. Protéger l'autre personnel travaillant à proximité au soudage à l'aide d'écrans appropriés et non-inflammables.

4. Des gouttes de laitier en fusion sont émises de l'arc de soudage. Se protéger avec des vêtements de protection libres de l'huile, tels que les gants en cuir, chemise épaisse, pantalons sans revers, et chaussures montantes.

5. Toujours porter des lunettes de sécurité dans la zone de soudage. Utiliser des lunettes avec écrans lateraux dans les zones où l'on pique le laitier.

6. Eloigner les matériaux inflammables ou les recouvrir afin de prévenir tout risque d'incendie dû aux étincelles.

7. Quand on ne soude pas, poser la pince à une endroit isolé de la masse. Un court-circuit accidental peut provoquer un échauffement et un risque d'incendie.

8. S'assurer que la masse est connectée le plus prés possible de la zone de travail qu'il est pratique de le faire. Si on place la masse sur la charpente de la construction ou d'autres endroits éloignés de la zone de travail, on augmente le risque de voir passer le courant de soudage par les chaines de levage, câbles de grue, ou autres circuits. Cela peut provoquer des risques d'incendie ou d'echauffement des chaines et des câbles jusqu'à ce qu'ils se rompent.

9. Assurer une ventilation suffisante dans la zone de soudage. Ceci est particuliérement important pour le soudage de tôles galvanisées plombées, ou cadmiées ou tout autre métal qui produit des fumeés toxiques.

10. Ne pas souder en présence de vapeurs de chlore provenant d'opérations de dégraissage, nettoyage ou pistolage. La chaleur ou les rayons de l'arc peuvent réagir avec les vapeurs du solvant pour produire du phosgéne (gas fortement toxique) ou autres produits irritants.

11. Pour obtenir de plus amples renseignements sur la sûreté, voir le code "Code for safety in welding and cutting" CSA Standard W 117.2-1974.

PRÉCAUTIONS DE SÛRETÉ POUR LES MACHINES À SOUDER À TRANSFORMATEUR ET À REDRESSEUR

1. Relier à la terre le chassis du poste conformement au code de l'électricité et aux recommendations du fabricant. Le dispositif de montage ou la piece à souder doit être branché à une bonne mise à la terre.

2. Autant que possible, l'installation et l'entretien du poste seront effectués par un électricien qualifié.

3. Avant de faires des travaux à l'interieur de poste, la debrancher à l'interrupteur à la boite de fusibles.

4. Garder tous les couvercles et dispositifs de sûreté à leur place.

Return to Master TOC
Return to Master TOC
Return to Master TOC
Return to Master TOC

Electromagnetic Compatibility (EMC)

Conformance
Products displaying the CE mark are in conformity with European Community Council Directive of 15 Dec 2004 on the approximation of the laws of the Member States relating to electromagnetic compatibility, 2004/108/EC. It was manufactured in conformity with a national standard that implements a harmonized standard: EN 60974-10 Electromagnetic Compatibility (EMC) Product Standard for Arc Welding Equipment. It is for use with other Lincoln Electric equipment. It is designed for industrial and professional use.

Introduction
All electrical equipment generates small amounts of electromagnetic emission. Electrical emission may be transmitted through power lines or radiated through space, similar to a radio transmitter. When emissions are received by other equipment, electrical interference may result. Electrical emissions may affect many kinds of electrical equipment; other nearby welding equipment, radio and TV reception, numerical controlled machines, telephone systems, computers, etc. Be aware that interference may result and extra precautions may be required when a welding power source is used in a domestic establishment.

Installation and Use
The user is responsible for installing and using the welding equipment according to the manufacturer's instructions. If electromagnetic disturbances are detected then it shall be the responsibility of the user of the welding equipment to resolve the situation with the technical assistance of the manufacturer. In some cases this remedial action may be as simple as earthing (grounding) the welding circuit, see Note. In other cases it could involve construction of an electromagnetic screen enclosing the power source and the work complete with associated input filters. In all cases electromagnetic disturbances must be reduced to the point where they are no longer troublesome.

Note: The welding circuit may or may not be earthed for safety reasons according to national codes. Changing the earthing arrangements should only be authorized by a person who is competent to access whether the changes will increase the risk of injury, e.g., by allowing parallel welding current return paths which may damage the earth circuits of other equipment.

Assessment of Area
Before installing welding equipment the user shall make an assessment of potential electromagnetic problems in the surrounding area. The following shall be taken into account:

a) other supply cables, control cables, signaling and telephone cables; above, below and adjacent to the welding equipment;

b) radio and television transmitters and receivers;

c) computer and other control equipment;

d) safety critical equipment, e.g., guarding of industrial equipment;

e) the health of the people around, e.g., the use of pacemakers and hearing aids;

f) equipment used for calibration or measurement

g) the immunity of other equipment in the environment. The user shall ensure that other equipment being used in the environment is compatible. This may require additional protection measures;

h) the time of day that welding or other activities are to be carried out.

Return to Master TOC
Return to Master TOC
Return to Master TOC
Return to Master TOC

Electromagnetic Compatibility (EMC)

The size of the surrounding area to be considered will depend on the structure of the building and other activities that are taking place. The surrounding area may extend beyond the boundaries of the premises.

Methods of Reducing Emissions

Mains Supply
Welding equipment should be connected to the mains supply according to the manufacturer's recommendations. If interference occurs, it may be necessary to take additional precautions such as filtering of the mains supply. Consideration should be given to shielding the supply cable of permanently installed welding equipment, in metallic conduit or equivalent. Shielding should be electrically continuous throughout its length. The shielding should be connected to the welding power source so that good electrical contact is maintained between the conduit and the welding power source enclosure.

Maintenance of the Welding Equipment
The welding equipment should be routinely maintained according to the manufacturer's recommendations. All access and service doors and covers should be closed and properly fastened when the welding equipment is in operation. The welding equipment should not be modified in any way except for those changes and adjustments covered in the manufacturers instructions. In particular, the spark gaps of arc striking and stabilizing devices should be adjusted and maintained according to the manufacturer's recommendations.

Welding Cables
The welding cables should be kept as short as possible and should be positioned close together, running at or close to floor level.

Equipotential Bonding
Bonding of all metallic components in the welding installation and adjacent to it should be considered. However, metallic components bonded to the work piece will increase the risk that the operator could receive a shock by touching these metallic components and the electrode at the same time. The operator should be insulated from all such bonded metallic components.

Earthing of the Workpiece
Where the workpiece is not bonded to earth for electrical safety, not connected to earth because of its size and position, e.g., ships hull or building steelwork, a connection bonding the workpiece to earth may reduce emissions in some, but not all instances. Care should be taken to prevent the earthing of the workpiece increasing the risk of injury to users, or damage to other electrical equipment. Where necessary, the connection of the workpiece to earth should be made by a direct connection to the workpiece, but in some countries where direct connection is not permitted, the bonding should be achieved by suitable capacitance, selected according to national regulations.

Screening and Shielding
Selective screening and shielding of other cables and equipment in the surrounding area may alleviate problems of interference. Screening of the entire welding installation may be considered for special applications. [1]

---

[1] Portions of the preceding text are contained in EN 60974-10: "Electromagnetic Compatibility (EMC) product standard for arc welding equipment."

- MASTER TABLE OF CONTENTS FOR ALL SECTIONS -

TABLE OF CONTENTS - INSTALLATION SECTION

Return to Master TOC
Return to Master TOC
Return to Master TOC
Return to Master TOC

Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC

TECHNICAL SPECIFICATIONS - POWER WAVE® i400 (K2669-1, K2673-1)

INPUT AT RATED OUTPUT - THREE PHASE ONLY

Model	Duty Cycle	Input Voltage ± 10%	Input Amperes (incl. robot and aux. load)	Idle Power	Power Factor @ Rated Output
K2669-1 K2673-1 (Chassis Only)	40% rating	**208†**/230/**380***/460/575 3 phase 50/60 Hz **(† includes 200V to 208V)** **(* includes 380V to 415V)**	57/51/30/26/21 (75/68/40/34/27)	475 Watts Max. (fan on)	.95
	60% rating		53/48/28/24/19 (72/65/38/33/26)		
	100% rating		44/39/23/20/16 (62/56/33/28/22)		

RATED OUTPUT

Process	Duty Cycle	Volts at Rated Amperes	Amperes
GMAW GMAW-Pulse FCAW GTAW-DC	40%	37	420
	60%	36	400
	100%	32	350

RECOMMENDED INPUT WIRE AND FUSE SIZES[1]

3 PHASE INPUT VOLTAGE 50/60Hz	Input Amperes (incl. robot and aux. load)	Type 75°C Copper Wire in Conduit AWG (mm²)	COPPER GROUNDING CONDUCTOR AWG (mm²)	Fuse (Super Lag) or Breaker Size[2]
208	57 (75)	4 (25)	8 (10)	80
230	51 (68)	4 (25)	8 (10)	70
380	31 (41)	6 (16)	10 (6)	50
460	26 (34)	8 (10)	10 (6)	40
575	21 (27)	8 (10)	10 (6)	30

1 Wire and Fuse Sizes based upon the U.S. National Electric Code and maximum output for 40°C (104°) ambient.

2 Also called “inverse time” or “thermal/magnetic” circuit breakers; circuit breakers that have a delay in tripping action that decreases as the magnitude of current increases.

PHYSICAL DIMENSIONS

MODEL	HEIGHT	WIDTH	DEPTH	WEIGHT
K2669-1	22.7 in. (577 mm)	24.4 in. (620 mm)	21.5 in. (546 mm)	209 lbs. (95 kg.)
K2673-1 (Chassis Only)	21.0 in. (533 mm)	22.6 in. (574 mm)	18.5 in. (470 mm)	147 lbs. (66.8 kg.)

TEMPERATURE RANGES

OPERATING TEMPERATURE RANGE	STORAGE TEMPERATURE RANGE
14°F to 104°F (-10C to 40C)	-40°F to 185°F(-40°C to 85°C)

TECHNICAL SPECIFICATIONS - POWER WAVE® i400 (K2669-1, K2673-1)

REGULATORY REQUIREMENTS					
MODEL	**Market**	**Conformity Mark**	**Standard**	**Enclosure Rating**	**Insulation Class**
K2669-1 K2673-1[3] (Chassis Only)	Europe	CE[4] C-Tick	EN 60974-1 EN 50199	IP21S	Class F (155°C)
	US and Canada	$CSA_{C/UL}$	C22.2 No. 60 UL551		

[3] Chassis ratings applicable only when installed as a replacement in the POWER WAVE® i400 cabinet.

[4] K2670-[ ] CE Filter Kit is required to meet CE and C-Tick conducted emission requirements.

Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC

Return to Section TOC
Return to Master TOC

SAFETY PRECAUTIONS

Read this entire installation section before you start installation.

⚠ WARNING

ELECTRIC SHOCK can kill.

- **Only qualified personnel should perform this installation.**
- **Turn the input power OFF at the disconnect switch or fuse box before working on this equipment. Turn off the input power to any other equipment connected to the welding system at the disconnect switch or fuse box before working on the equipment.**
- **Do not touch electrically hot parts.**
- **Always connect the POWER WAVE® grounding lug (located inside the reconnect input access door) to a proper safety (Earth) ground.**

LOCATION AND MOUNTING

The POWER WAVE® i400 case is designed to support the Fanuc R30iA controller and op box (up to 300lbs), matching the controller's footprint and styling. Mounting is externally accessible for simplified integration. The flexibility of the POWER WAVE® i400 also allows it to be operated as a stand alone unit. In either case, bolting the unit to the floor or a suitable platform is recommended to provide maximum stability.

⚠ CAUTION

- **DO NOT MOUNT OVER COMBUSTIBLE SURFACES. Where there is a combustible surface directly under stationary or fixed electrical equipment, that surface shall be covered with a steel plate at least .06"(1.6mm) thick, which shall extend not less than 5.90"(150mm) beyond the equipment on all sides.**

ENVIRONMENTAL CONSIDERATIONS

The POWER WAVE® i400 will operate in harsh environments. Even so, it is important that simple preventative measures are followed in order to assure long life and reliable operation.

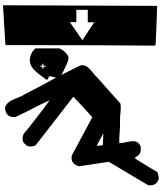
- The POWER WAVE® i400 must be located where there is free circulation of clean air such that air movement in the louvered sections of the machine will not be restricted.

- Dirt and dust that can be drawn into the POWER WAVE® i400 should be kept to a minimum. The use of air filters on the air intake is not recommended because normal air flow may be restricted. Failure to observe these precautions can result in excessive operating temperatures and nuisance shutdown.

- Do not use the POWER WAVE® i400 in an outdoor environment. The power source should not be subjected to falling water, nor should any parts of it be submerged in water. Doing so may cause improper operation as well as pose a safety hazard. The best practice is to keep the machine in a dry, sheltered area.

LIFTING

⚠ WARNING



- **Lift only with equipment of adequate lifting capacity.**
- **Be sure machine is stable when lifting.**
- **Do not lift this machine using lift bail if it is equipped with a heavy accessory such as trailer or gas cylinder.**

FALLING EQUIPMENT can cause injury.

- **Do not lift machine if lift bail is damaged.**
- **Do not operate machine while suspended from lift bail.**

POWER WAVE® i400: Lift the machine by the corner mounted lift bails only. Do not attempt to lift the POWER WAVE® i400 with accessories attached to it.

POWER WAVE® i400 with the Fanuc R30iA Controller: When properly mounted the complete integrated unit (power source and controller) can be lifted using the lift hooks provided on the Fanuc R30iA controller. Consult the Fanuc instruction manual for details and precautions.

NOTE: The POWER WAVE® i400 external corner mounted lift bales must be removed when mounted to the Fanuc R30iA controller.

POWER WAVE® i400 Replacement Chassis: Lift the chassis by the lift bail on top of the harmonic filter assembly.

STACKING

The POWER WAVE® i400 cannot be stacked.

Return to Section TOC
Return to Master TOC

ELECTROMAGNETIC COMPATIBILITY (EMC)

The EMC classification of the POWER WAVE® i400 is Industrial, Scientific and Medical (ISM) group 2, class A. The POWER WAVE® i400 is for industrial use only. (See prints L10093-1, -2 Safety Pages in the front of Instruction Manual for further details).

Locate the POWER WAVE® i400 away from radio controlled machinery. The normal operation of the POWER WAVE® i400 may adversely affect the operation of RF controlled equipment, which may result in bodily injury or damage to the equipment.

INPUT AND GROUNDING CONNECTIONS

MACHINE GROUNDING

The frame of the welder must be grounded. A ground terminal marked with the symbol shown is located inside the reconnect/input access door for this purpose. See your local and national electrical codes for proper grounding methods.

INPUT CONNECTIONS

⚠ WARNING

ELECTRIC SHOCK can kill.

- **Only a qualified electrician should connect the input leads to the POWER WAVE®. Connections should be made in accordance with all local and National Electrical Codes and the connection diagram located on the inside of the reconnect / input access door of the machine. Failure to do so may result in bodily injury or death.**

Use a three-phase supply line. A 1.75 inch (45 mm) diameter access hole for the input supply is located on the case back. Connect L1, L2, L3 and ground according to the input supply and ground connection decals located near the input power terminal block (1TB) and ground block inside of the rear input reconnect box.

Input Fuse and Supply Wire Considerations

Refer to Specification in Installation Section for recommended fuse, wire sizes and type of the copper wires. Fuse the input circuit with the recommended super lag fuse or delay type breakers (also called "inverse time" or "thermal/magnetic" circuit breakers).

Choose input and grounding wire size according to local or national electrical codes. Using input wire sizes, fuses or circuit breakers smaller than recommended may result in "nuisance" shut-offs from welder inrush currents, even if the machine is not being used at high currents.

Input Voltage Selection

(***See Figure A.1***)

The POWER WAVE® i400 is shipped connected for the highest input voltage listed on the rating plate. To move this connection to a different input voltage, see the diagram located on the inside of the reconnect access door, also illustrated below. If the Auxiliary lead (indicated as 'A') is placed in the wrong position, there are two possible results. If the lead is placed in a position higher than the applied line voltage, the welder may not come on at all. If the Auxiliary lead is placed in a position lower than the applied line voltage, the welder will not come on, and the fuse located in the reconnect area will open. If this occurs, turn off the input voltage, properly connect the auxiliary lead, replace the fuse, and try again.

Power Supply Connection for the Fanuc R30iA Controller

The POWER WAVE® i400 is equipped with a dedicated robot power terminal block (4TB) specifically designed to feed input power directly to the Fanuc R30iA controller through the power source rotary ON/OFF switch. The K2677-1 Integration kit provides the proper cable and installations instructions to make this connection.

⚠ WARNING

The POWER WAVE® i400 on/off switch is not intended as a service disconnect for this equipment. Only a qualified electrician should connect the input leads to the POWER WAVE®. Connections should be made in accordance with all local and national electrical codes and the connection diagram located on the inside of the reconnect access door of the machine. Failure to do so may result in bodily injury or death.

FIGURE A.1

Reconnect Diagram for K2669-1 POWER WAVE® i400

CONNECTION DIAGRAMS AND SYSTEM

RECOMMENDED EQUIPMENT

System Identifier	Part No.	Description
Power Source	K2669-1	**POWER WAVE® i400** Power Source (includes S26064 POWER WAVE® Utilities CD)
Integration Kit	K2677-1	**Integration Kit for Fanuc R30iA Controller.** Includes industrial ethernet cable, power cable, protective grommets, mounting plate, and dust proof strain relief.
Wire Drive	K2685-2	**AutoDrive 4R90** Wire Drive
Power Source to Wire Drive Control Cable	K1785-xx[1]	**Feeder Control Cable** (14 pin).
Weld Cables	K2163-xx -or- K1842-xx	**Welding Power Cables** Power Source to Wire Drive, and Power Source to Work **K2163** Series cables sold in pairs. **K1842** Series cables sold individually. See Price Book for details and bulk cable availability.
Robot Arm	Kxxxx	**Consult Automation Division**
Robot Controller	Kxxxx	
Torch	Kxxxx	

[1] Maximum length 100 ft.(30.5 m) Cannot be connected end to end.

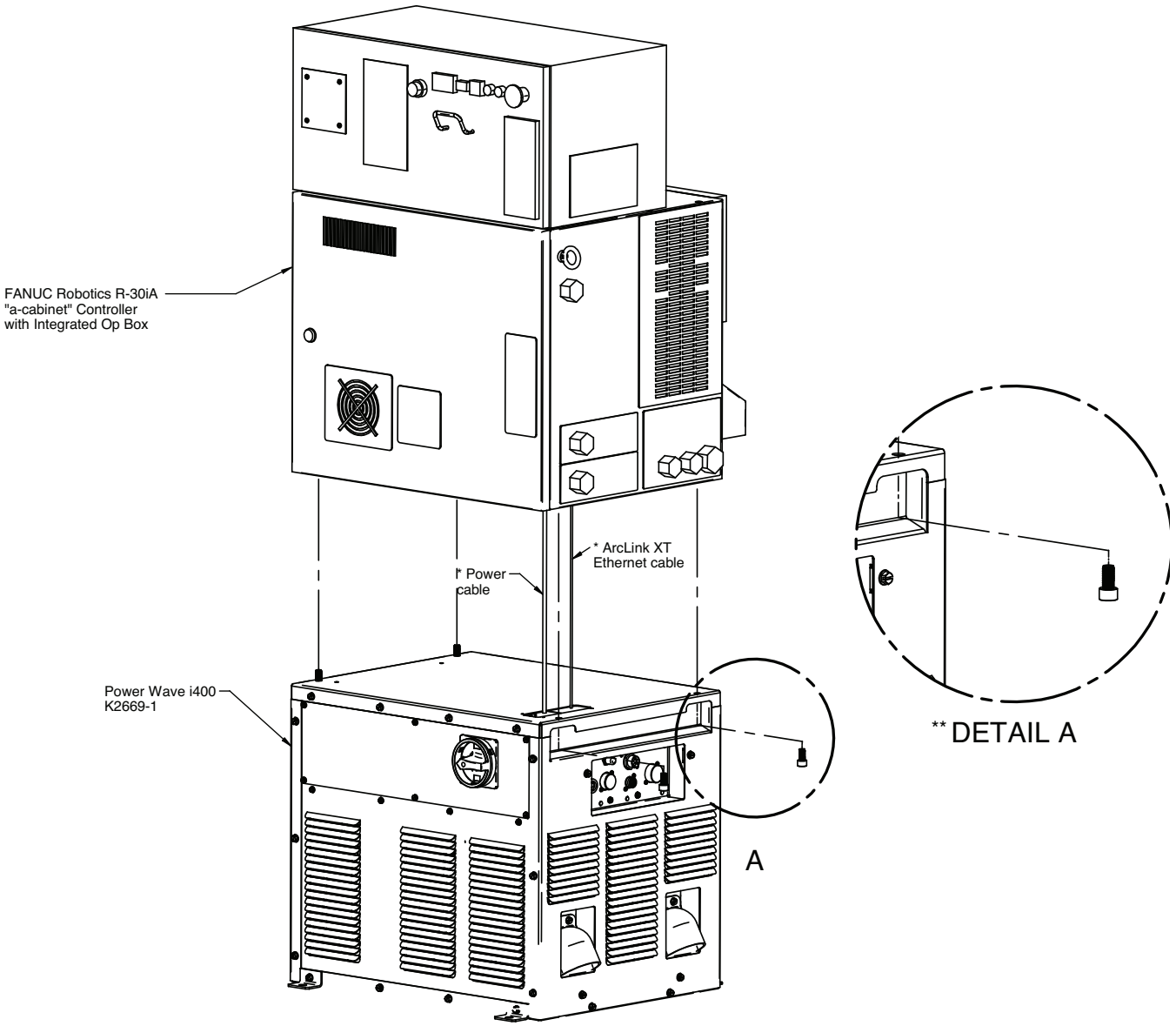
OPTIONAL EQUIPMENT

System Identifier	Part No.	Description
CE Filter Kit	K2677-1	**CE Filter Kit.** Required to meet CE and C-Tick conducted emission requirements. Input voltage limited to 380-415/3/50/60 with kit installed
ArcLink Digital Communication Cable	K1543-xx[2] K2683-xx[2]	**ArcLink Control Cable** (5 pin). Required for earlier controllers communicating via traditional ArcLink® over a standard 2 wire CAN based network. K2683 Recommended on Sever Duty application.
External Ethernet Network Equipment	Customer Supplied	**Ethernet Switch, Cables, etc.** Required for external Ethernet system connectivity typically associated with multiple arm or multiple power source applications.
DeviceNet Cables and Accessories	Customer Supplied	**DeviceNet Cables, Tees, and Terminators** (5 pin sealed "mini style") Typically required for PLC or earlier model controllers communicating via DeviceNet. For additional information refer to the "DeviceNet Cable Planning and Installation Manual" (Allen Bradley publication DN-6.7.2).
Coaxial Weld Cable	K1796-xx K2593-xx	**Coax Cable.** Recommended to minimize the effects of the weld cable loop inductance and maximize performance in critical high speed pulse applications. Note: K1796 coaxial cable is equivalent to 1/0 standard cable. K2539 coaxial cable is equivalent to AWG #1 standard cable. Connecting coaxial cables in parallel to increase current carrying capacity can significantly reduce their inductance minimizing properties, and is therefore NOT RECOMMENDED. Consult the Output Cable Guidelines for further information.
External Dress Cable for Robot Arm	K2709-xx	**External Dress Cable.** Heavy duty externally mounted 14pin wire feeder cable for use with robot arms not equipped with an integral cable.
Personal Computer	Customer Supplied	**IBM Compatible PC** (Windows NT SP6, Windows 2000, Windows XP, or greater) required for use with all **POWER WAVE® Utilities**
Replacement Chassis	K2673-1	POWER WAVE® i400 Replacement Chassis. Complete inverter power section. Intended only as a replacement to be installed in the POWER WAVE® i400 cabinet (includes S26064 POWER WAVE® Utilities CD).

[2] Cables can be connected end to end to extend length (recommended maximum 200 ft [61.0m]).

Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC

FANUC R30iA CONTROLLER MOUNTING

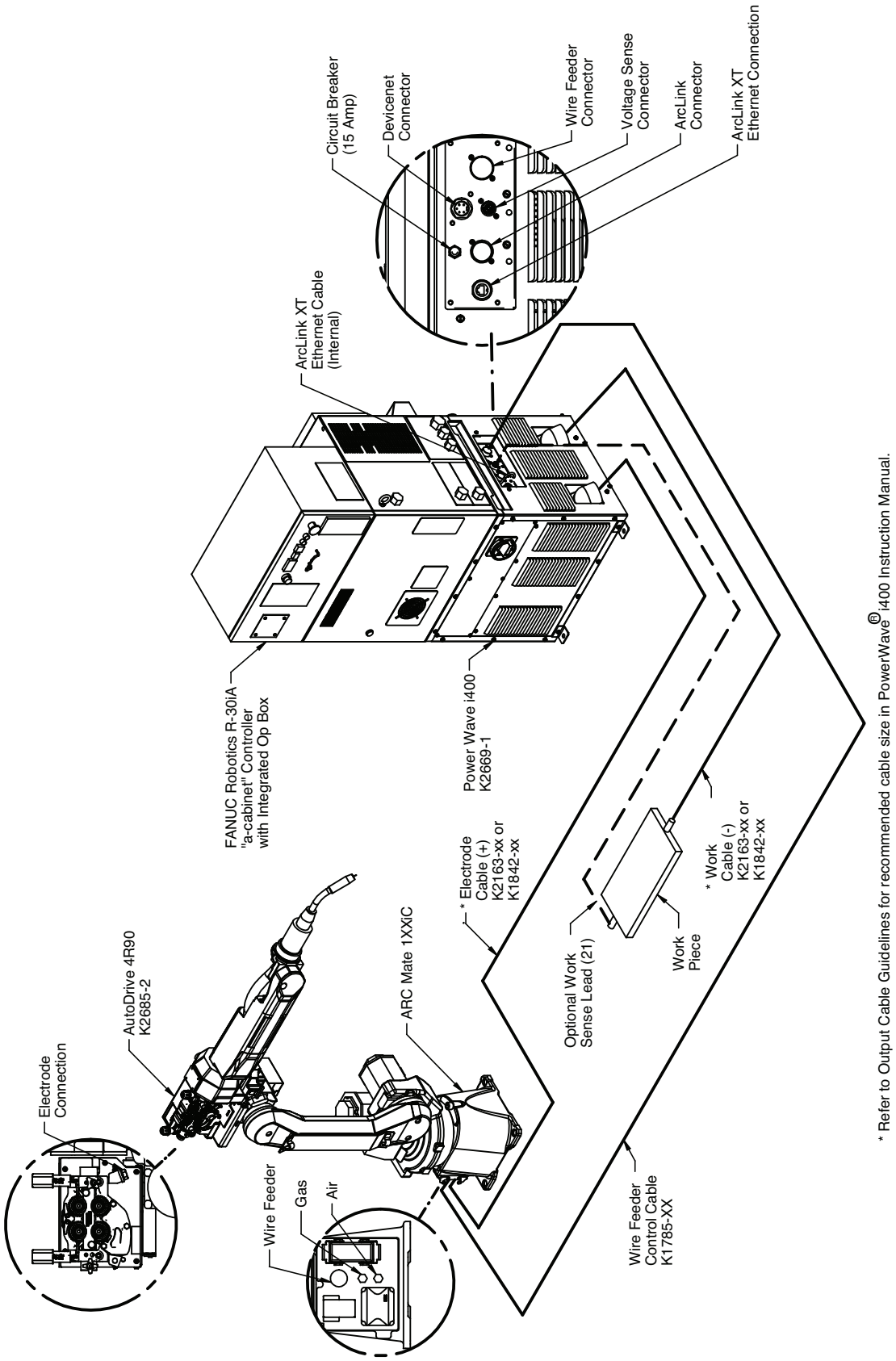


* Refer to Output Cable guidelines for recommended cable size in PowerWave® i400 Instruction Manual.

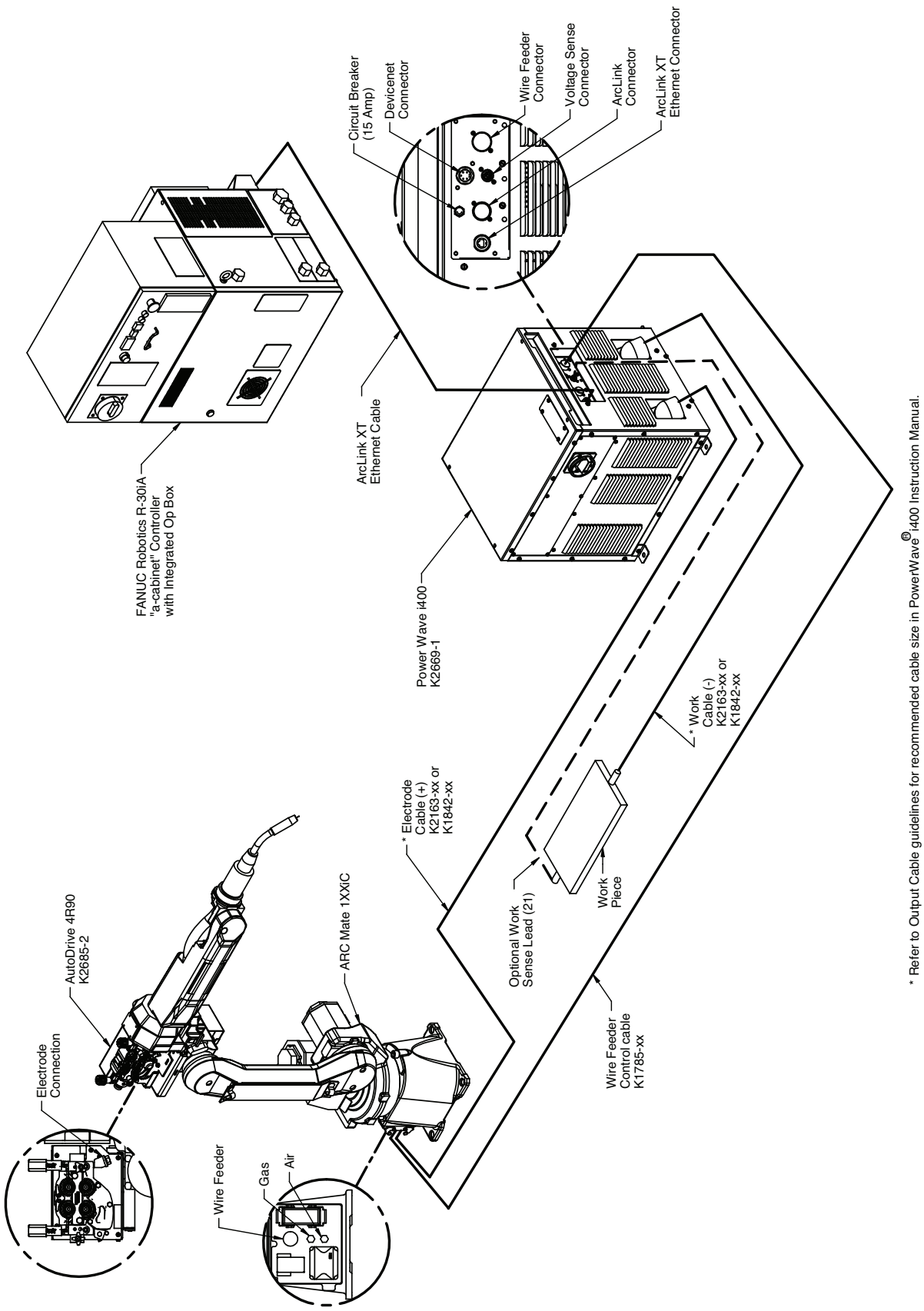
** Refer to Intergration kit K2677-1 instruction sheet

Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC

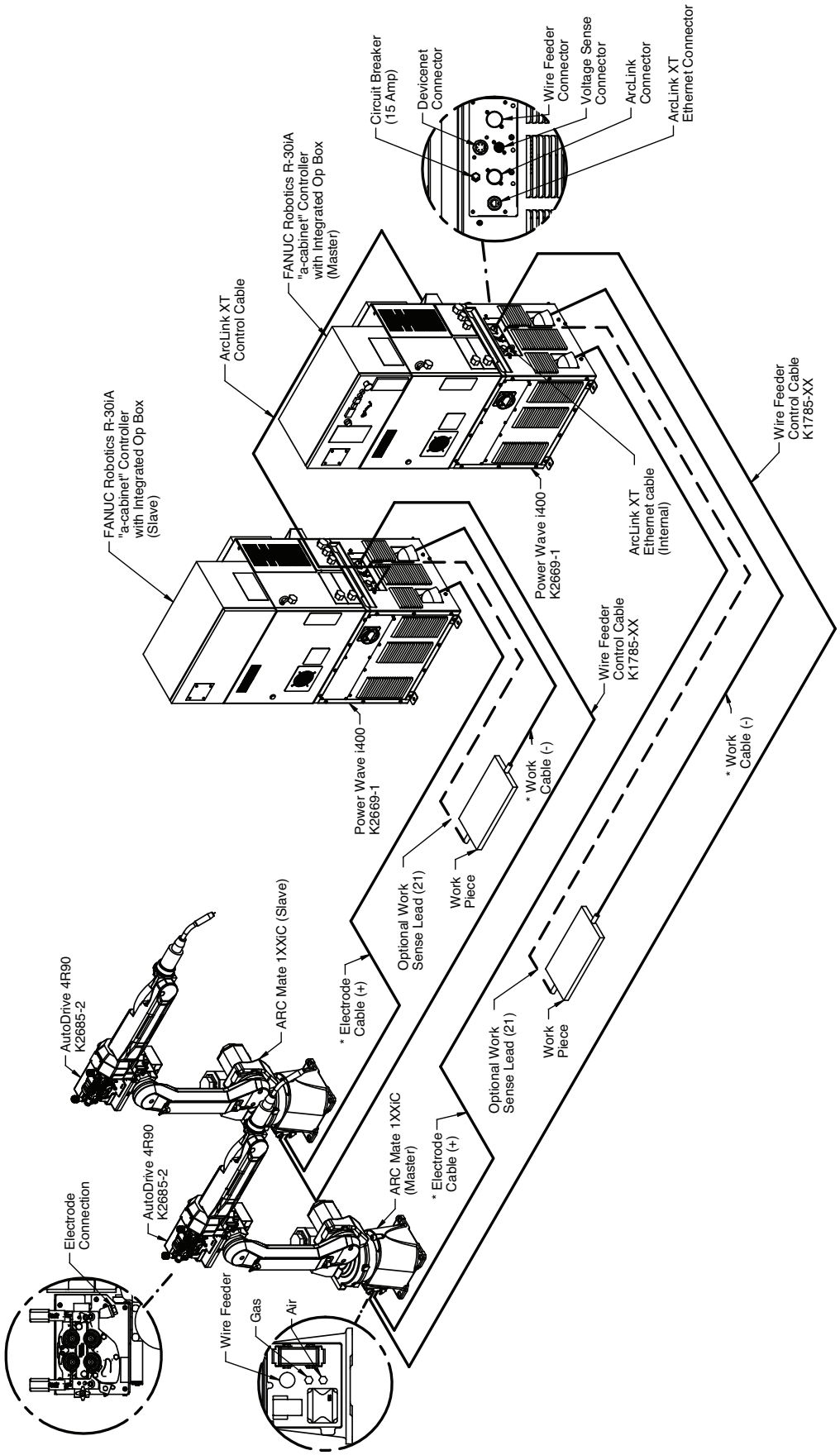
TYPICAL INTEGRATED SYSTEMS (SINGLE ARM)



TYPICAL STAND ALONE SYSTEMS (SINGLE ARM)



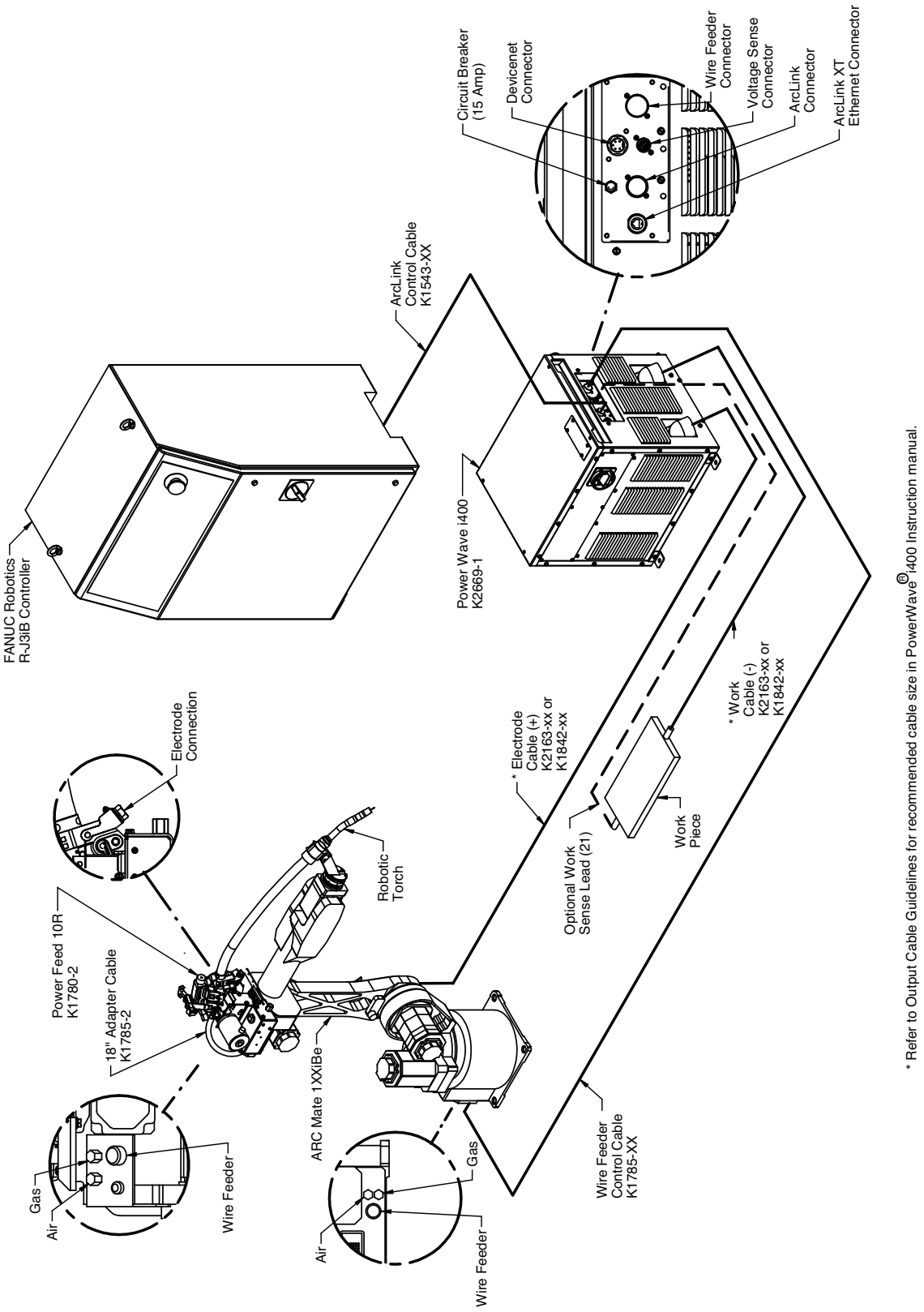
TYPICAL MASTER / SLAVE SYSTEM (DUAL ARM)



* Refer to Output Cable Guidelines for recommended cable size in PowerWave® i400 Instruction Manual.

Return to Section TOC
Return to Master TOC

TYPICAL F355i RETROFIT (SINGLE ARM)



* Refer to Output Cable Guidelines for recommended cable size in PowerWave® i400 Instruction manual.

Return to Section TOC
Return to Master TOC

ELECTRODE AND WORK CONNECTIONS

Connect the electrode and work cables between the appropriate output studs of the POWER WAVE® i400 and the robot weld cell per the connection diagrams included in this document. Size and route the cables per the following.

- Most welding applications run with the electrode being positive (+). For those applications, connect the electrode cable between the wire drive feed plate and the positive (+) output stud on the power source. Connect a work lead from the negative (-) power source output stud to the work piece.

- When negative electrode polarity is required, such as in some Innershield applications, reverse the output connections at the power source (electrode cable to the negative (-) stud, and work cable to the positive (+) stud).

⚠ CAUTION

Negative electrode polarity operation WITHOUT use of a remote work sense lead (21) requires the Negative Electrode Polarity attribute to be set. See the Remote Sense Lead Specification section of this document for further details.

For additional Safety information regarding the electrode and work cable set-up, See the standard ***SAFETY INFORMATION*** located in the front of this Instruction Manual.

GENERAL GUIDELINES

- **Select the appropriate size cables per the "Output Cable Guidelines" in Table A.1**. Excessive voltage drops caused by undersized welding cables and poor connections often result in unsatisfactory welding performance. Always use the largest welding cables (electrode and work) that are practical, and be sure all connections are clean and tight.

Note: Excessive heat in the weld circuit indicates undersized cables and/or bad connections.

- **Route all cables directly to the work and wire feeder, avoid excessive lengths and do not coil excess cable.** Route the electrode and work cables in close proximity to one another to minimize the loop area and therefore the inductance of the weld circuit.

- **Always weld in a direction away from the work (ground) connection.**

In **Table A.1** are copper cable sizes recommended for different currents and duty cycles. Lengths stipulated are the distance from the welder to work and back to the welder again. Cable sizes are increased for greater lengths primarily for the purpose of minimizing cable drop.

TABLE A.1
OUTPUT CABLE GUIDELINES

Amperes	Percent Duty Cycle	CABLE SIZES FOR COMBINED LENGTHS OF ELECTRODE AND WORK CABLES (RUBBER COVERED COPPER - RATED 75°C)**				
		0 to 50 Ft.	50 to 100 Ft.	100 to 150 Ft.	150 to 200 Ft.	200 to 250 Ft.
200	60	2	2	2	1	1/0
200	100	2	2	2	1	1/0
225	20	4 or 5	3	2	1	1/0
225	40 & 30	3	3	2	1	1/0
250	30	3	3	2	1	1/0
250	40	2	2	1	1	1/0
250	60	1	1	1	1	1/0
250	100	1	1	1	1	1/0
300	60	1	1	1	1/0	2/0
325	100	2/0	2/0	2/0	2/0	3/0
350	60	1/0	1/0	2/0	2/0	3/0
400	60	2/0	2/0	2/0	3/0	4/0
400	100	3/0	3/0	3/0	3/0	4/0
500	60	2/0	2/0	3/0	3/0	4/0

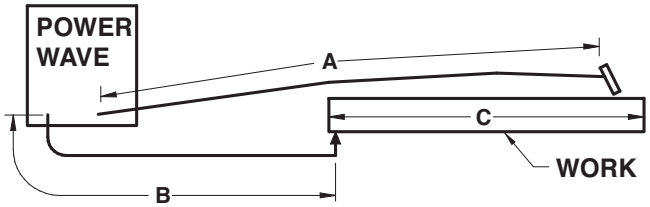
** Tabled values are for operation at ambient temperatures of 40°C and below. Applications above 40°C may require cables larger than recommended, or cables rated higher than 75°C.

Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC

CABLE INDUCTANCE, AND ITS EFFECTS ON WELDING

Excessive cable inductance will cause the welding performance to degrade. There are several factors that contribute to the overall inductance of the cabling system including cable size, and loop area. The loop area is defined by the separation distance between the electrode and work cables, and the overall welding loop length. The welding loop length is defined as the total of length of the electrode cable (A) + work cable (B) + work path (C) (see Figure A.2). To minimize inductance always use the appropriate size cables, and whenever possible, run the electrode and work cables in close proximity to one another to minimize the loop area. Since the most significant factor in cable inductance is the welding loop length, avoid excessive lengths and do not coil excess cable. For long work piece lengths, a sliding ground should be considered to keep the total welding loop length as short as possible.

FIGURE A.2



REMOTE SENSE LEAD CONNECTIONS

Voltage Sensing Overview

The best arc performance occurs when the POWER WAVE® i400 has accurate data about the arc conditions. Depending upon the process, inductance within the electrode and work cables can influence the voltage apparent at the studs of the welder, and have a dramatic effect on performance. Remote voltage sense leads are used to improve the accuracy of the arc voltage information supplied to the control pc board. Sense Lead Kits (K940-xx) are available for this purpose.

⚠ CAUTION

If the remote voltage sensing is enabled but the sense leads are missing, improperly connected, or if the electrode polarity attribute is improperly configured extremely high welding outputs may occur.

General Guidelines for Voltage Sense Leads

Sense leads should be attached as close to the weld as practical, and out of the weld current path when possible. In extremely sensitive applications it may be necessary to route cables that contain the sense leads away from the electrode and work welding cables.

Voltage sense leads requirements are based on the weld process as follows:

TABLE A.2

Process	Electrode Voltage Sensing (67 lead) [1]	Work Voltage Sensing (21 lead) [2]
GMAW	67 lead required	21 lead optional [3]
GMAW-P	67 lead required	21 lead optional [3]
FCAW	67 lead required	21 lead optional [3]
GTAW	Voltage sense at studs	Voltage sense at studs

[1] The electrode voltage sense lead (67) is automatically enabled by the weld process, and integral to the to the 14 pin wire feeder control cable (K1785).

[2] The work voltage sense lead (21) is manually enabled, but overridden by constant current weld processes defined for stud sensing.

[3] Negative polarity semi-automatic process operation WITHOUT use of a remote work sense lead (21) requires the Negative Electrode Polarity attribute to be set.

Electrode Voltage Sensing

The remote ELECTRODE sense lead (67) is built into the standard wire feeder control cable (K1785) and is always connected to the wire drive feed plate when a wire feeder is present. Enabling or disabling electrode voltage sensing is application specific, and automatically configured by the active weld mode.

The remote ELECTRODE sense lead (67) is also available in the remote Voltage Sense Connector for applications that do not use the standard wire feeder control cable (K1785).

Return to Section TOC
Return to Master TOC

Work Voltage Sensing

The POWER WAVE® i400 is configured at the factory to sense work voltage at the negative output stud (positive output polarity with remote Work Voltage Sensing disabled).

⚠ CAUTION

Negative electrode polarity operation WITHOUT use of a remote work sense lead (21) requires the Negative Electrode Polarity attribute to be set via the Fanuc Teach Pendant or by the appropriate PC tool.

While most applications perform adequately by sensing the work voltage directly at the output stud, the use of a remote work voltage sense lead is recommended for optimal performance. The remote WORK sense lead (21) can be accessed through the four-pin voltage sense connector located on the control panel by using the K940 Sense Lead Kit. It must be attached to the work as close to the weld as practical, but out of the weld current path. For more information regarding the placement of remote work voltage sense leads, see the section entitled "Voltage Sensing Considerations for Multiple Arc Systems."

⚠ WARNING

If a remote work voltage sense lead is used, it must be enabled through the Fanuc Teach Pendant or by the appropriate PC tool.

Voltage Sensing Considerations for Multiple Arc Systems

Special care must be taken when more than one arc is welding simultaneously on a single part. Multiple arc applications do not necessarily dictate the use of remote work voltage sense leads, but they are strongly recommended.

If Sense Leads ARE NOT Used:

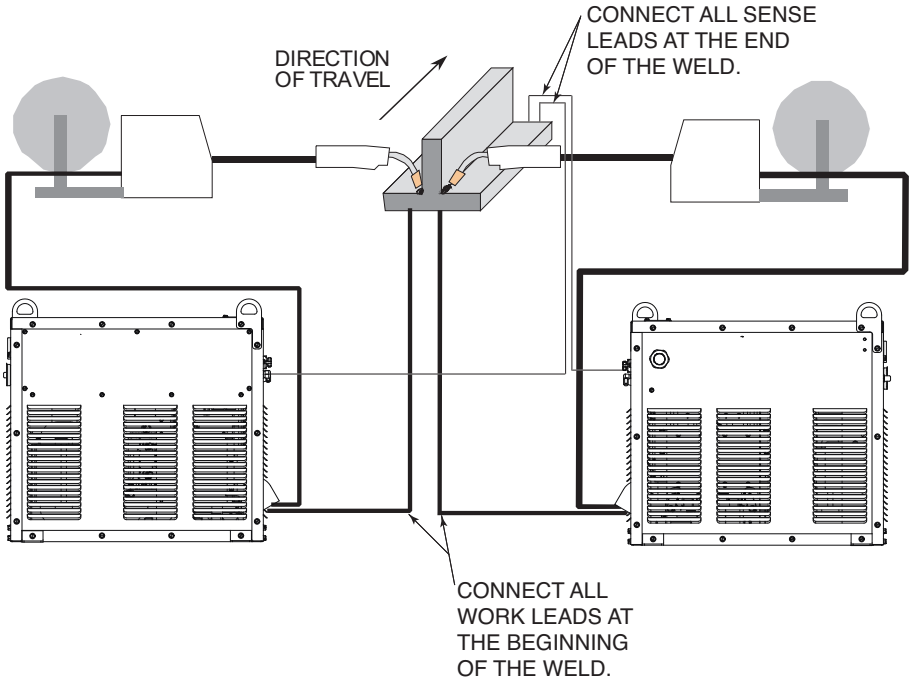
- Avoid common current paths. Current from adjacent arcs can induce voltage into each others current paths that can be misinterpreted by the power sources, and result in arc interference.

If Sense Leads ARE Used:

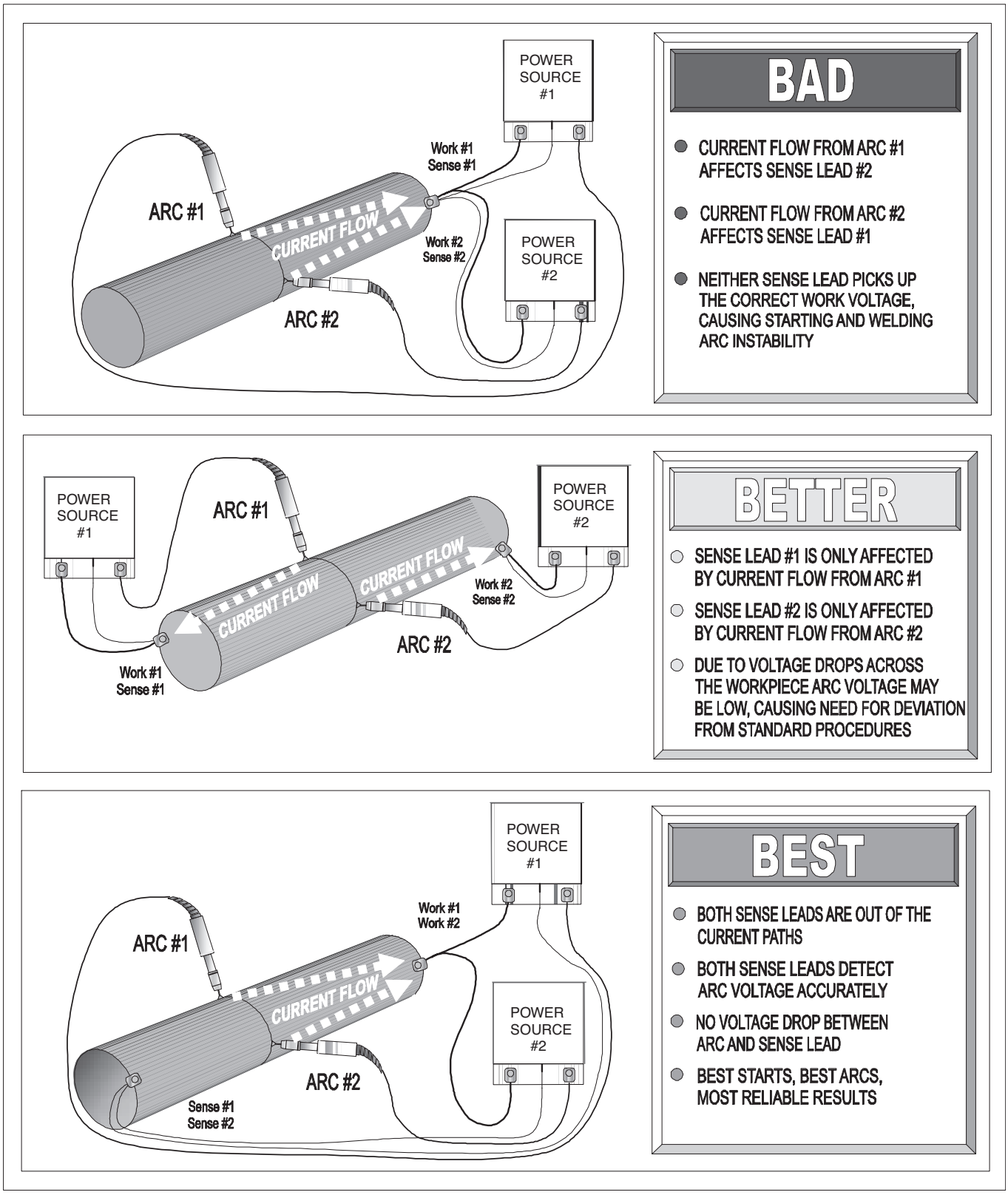
- **Position the sense leads out of the path of the weld current.** Especially any current paths common to adjacent arcs. Current from adjacent arcs can induce voltage into each others current paths that can be misinterpreted by the power sources, and result in arc interference.

- **For longitudinal applications**, connect all work leads at one end of the weldment, and all of the work voltage sense leads at the opposite end of the weldment. Perform welding in the direction away from the work leads and toward the sense leads. **(See Figure A.3**)

FIGURE A.3



- **For circumferential applications,** connect all work leads on one side of the weld joint, and all of the work voltage sense leads on the opposite side, such that they are out of the current path.



Return to Section TOC
Return to Master TOC

Return to Section TOC
Return to Master TOC

CONTROL CABLE CONNECTIONS

General Guidelines

Genuine Lincoln control cables should be used at all times (except where noted otherwise). Lincoln cables are specifically designed for the communication and power needs of the POWER WAVE® / Power Feed systems. Most are designed to be connected end to end for ease of extension. Generally, it is recommended that the total length not exceed 100 ft. (30.5 m). The use of non-standard cables, especially in lengths greater than 25 ft. (7.6 m), can lead to communication problems (system shutdowns), poor motor acceleration (poor arc starting), and low wire driving force (wire feeding problems). Always use the shortest length of control cable possible, and DO NOT coil excess cable.

Regarding cable placement, best results will be obtained when control cables are routed separate from the weld cables. This minimizes the possibility of interference between the high currents flowing through the weld cables, and the low level signals in the control cables. These recommendations apply to all communication cables including ArcLink® and Ethernet connections.

COMMON EQUIPMENT CONNECTIONS

Connection Between Power Source and Wire Feeder (K1785 or K2709 Control Cable)

The 14 pin wire feeder control cable connects the power source to the wire drive. It contains all of the necessary signals to drive the motor and monitor the arc, including the motor power, tachometer, and arc voltage feedback signals. The wire feeder connection on the POWER WAVE® i400 is located on the recessed control panel above the output studs. Fanuc robot arms are equipped with internal cabling and provide a standard 14 pin MS-style connection at the base of the robot, and near the wire feeder mount at the top of the arm. The K2709 series external dress cable is recommended for severe duty applications such as hard automation or for robot arms not equipped with an internal control cable. Best results will be obtained when control cables are routed separate from the weld cables, especially in long distance applications. Maximum cable length should not exceed 100ft(30.5m).

Connection Between Power Source and ArcLink® Compatible Controllers (K1543 or K2683 ArcLink Control Cable)

Earlier model Fanuc controllers communicate via traditional ArcLink® over a standard 2 wire CAN based network. In these systems, the 5 pin ArcLink control cable connects the power source to the controller. The control cable consists of two power leads, one twisted pair for digital communication, and one lead for voltage sensing. The sense leads and power leads are typically unused in this application. The 5 pin ArcLink connection on the POWER WAVE® i400 is located on the recessed control panel above the output studs. The control cable is keyed and polarized to prevent improper connection. Best results will be obtained when control cables are routed separate from the weld cables, especially in long distance applications. The recommended combined length of the ArcLink control cable network should not exceed 200ft(61.0m).

Connection Between Power Source and ArcLink®XT Compatible Controllers or Ethernet Networks. Newer model controllers, such as the Fanuc R30iA, communicate via ArcLink®XT over an industrial Ethernet connection. To facilitate this, the POWER WAVE® i400 is equipped with an IP67 rated ODVA compliant RJ-45 Ethernet connector, which is located on the recessed control panel above the output studs. A special access chute is provided above the Ethernet connection on the POWER WAVE® i400 to accommodate seamless integration with the Fanuc R30iA controller. The K2677-1 Integration Kit includes a specially designed industrial rated Ethernet cable for this purpose.

All external Ethernet equipment (cables, switches, etc.), as defined by the connection diagrams, must be supplied by the customer. It is critical that all Ethernet cables external to either a conduit or an enclosure are solid conductor, shielded cat 5e cable, with a drain. The drain should be grounded at the source of transmission. For best results, route Ethernet cables away from weld cables, wire drive control cables, or any other current carrying device that can create a fluctuating magnetic field. For additional guidelines refer to ISO/IEC 11801. Failure to follow these recommendations can result in an Ethernet connection failure during welding.

The ethernet port of the POWER WAVE® i400 is factory configured with a dynamic IP address. This is required for seamless operation with the Fanuc R30iA controller.

Connections Between Power Source and Optional DeviceNet PLC Controller. Hard Automation applications and some earlier model controllers may require DeviceNet connectivity. The POWER WAVE® i400 is equipped with a 5 pin DeviceNet sealed mini style receptacle for this purpose. The receptacle is located on the recessed control panel above the output studs. The DeviceNet cable is keyed and polarized to prevent improper connection. For best results, route DeviceNet cables away from weld cables, wire drive control cables, or any other current carrying device that can create a fluctuating magnetic field. DeviceNet cables must be sourced locally by the customer. For additional guidelines refer to the "DeviceNet Cable Planning and Installation Manual" (Allen Bradley publication DN-6.7.2).

The DeviceNet MAC ID and baud rate of the POWER WAVE® i400 can be configured with the Diagnostics Utility (included on the POWER WAVE® Utilities and Service Navigator DVD's or available at www.powerwavesoftware.com).

OTHER SET-UP ISSUES

Selecting a Wire Drive and Setting the Wire Drive Gear Ratio. The POWER WAVE® i400 can accommodate a number of standard wire drives including the AutoDrive 4R90 and PF-10R. The feeder control system must be configured for both the wire drive type and gear ratio (high or low speed range). This can be accomplished via the Fanuc Teach Pendant or with the Diagnostics Utility (included on the POWER WAVE® Utilities and Service Navigator DVD's or available at www.powerwavesoftware.com).

The AutoDrive 4R90 is the default wire drive for the POWER WAVE® i400.

Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC

TABLE OF CONTENTS - OPERATION SECTION

Return to Master TOC
Return to Master TOC
Return to Master TOC

SAFETY PRECAUTIONS

Read this entire section of operating instructions before operating the machine.

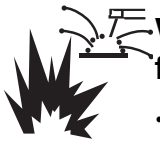
⚠ WARNING

ELECTRIC SHOCK can kill.

- **Unless using cold feed feature, when feeding with gun trigger, the electrode and drive mechanism are always electrically energized and could remain energized several seconds after the welding ceases.**
- **Do not touch electrically live parts or electrodes with your skin or wet clothing.**
- **Insulate yourself from the work and ground.**
- **Always wear dry insulating gloves.**

FUMES AND GASES can be dangerous.

- **Keep your head out of fumes.**
- **Use ventilation or exhaust to remove fumes from breathing zone.**



WELDING SPARKS can cause fire or explosion.

- **Keep flammable material away.**
- **Do not weld on containers that have held combustibles.**

ARC RAYS can burn.

- **Wear eye, ear, and body protection.**

Observe additional guidelines detailed in the beginning of this manual.

Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC

GRAPHIC SYMBOLS THAT APPEAR ON THIS MACHINE OR IN THIS MANUAL


INPUT POWER


ON


OFF


HIGH TEMPERATURE


MACHINE STATUS


CIRCUIT BREAKER


WIRE FEEDER


POSITIVE OUTPUT

NEGATIVE OUTPUT


3 PHASE INVERTER


INPUT POWER


THREE PHASE


DIRECT CURRENT

U_0 OPEN CIRCUIT VOLTAGE

U_1 INPUT VOLTAGE

U_2 OUTPUT VOLTAGE

I_1 INPUT CURRENT

I_2 OUTPUT CURRENT


PROTECTIVE GROUND


WARNING or CAUTION


Explosion


Dangerous Voltage


Shock Hazard

PRODUCT DESCRIPTION

PRODUCT SUMMARY

General Physical Description

The POWER WAVE® i400 is intended as a replacement for the PW355i using an updated power and control platform to enhance performance and reliability. The POWER WAVE® i400 includes an integrated wire drive module and 14-pin MS-Style connection to support the PF-10R and Auto Drive 4R90. ArcLink® communication is supported through the 5 pin MS-style interface. The new ArcLink®XT communication protocol is supported through an RJ-45 type Ethernet connection, which also provides access for the POWER WAVE® Utilities software tools. In addition, the DeviceNet communication protocol is supported by a 5 pin sealed mini style receptacle. Access to remote voltage sensing is available through the 4 pin sense lead connector (work and electrode), at the feeder via the 14 pin MS-style connector (electrode only), or at the 5 pin MS-style ArcLink® connector (electrode only).

The POWER WAVE® i400 includes an innovative new case design featuring a removable slide mounted power section for ease of service. The case is designed to support the Fanuc R30iA controller and optional box (up to 300lbs), matching both the controller's footprint and styling. Mounting is externally accessible for simplified integration. The flexibility of the POWER WAVE® i400 also allows it to be operated as a stand alone unit.

Input power for the Fanuc R30iA controller is supplied through the POWER WAVE® i400 on/off switch. The ArcLink®XT connection is provided through Ethernet. Both power and communication leads are routed to the controller via access holes in the top of the power source. The K2677-1 Integration Kit includes all necessary cables and hardware to complete this task.

General Functional Description

The POWER WAVE® i400 is a high performance, multi-process, digitally controlled inverter power source, designed as a pedestal to support the Fanuc R30iA controller. It may also be used with other controllers as a standalone power source. It is capable of producing a welding output from 5-420 amperes, and is rated for 350A, 100%.

The POWER WAVE® i400 utilizes the latest generation high speed digital controls, and communicates via ArcLink®XT to the Fanuc controller. The inverter power section utilizes state of the art power electronics and is re-connectable for 3 phase input voltages from 208 to 575VAC. A 15A auxiliary receptacle is provided for fume extraction and water cooler accessories.

The POWER WAVE® i400 is fully CE compatible when equipped with a K2670-1 CE Filter kit*.

* Input voltage limited to 380-415/3/50/60 with kit installed.

RECOMMENDED PROCESSES AND EQUIPMENT

RECOMMENDED PROCESSES

The POWER WAVE® i400 is a high speed, multi-process power source capable of regulating the current, voltage, or power of the welding arc. With an output range of 5 to 420 amperes, it supports a number of standard processes including synergic GMAW, GMAW-P and FCAW on various materials especially steel, aluminum and stainless.

PROCESS LIMITATIONS

The software based weld set of the POWER WAVE® i400 limit the process capability within the output range and the safe limits of the machine.

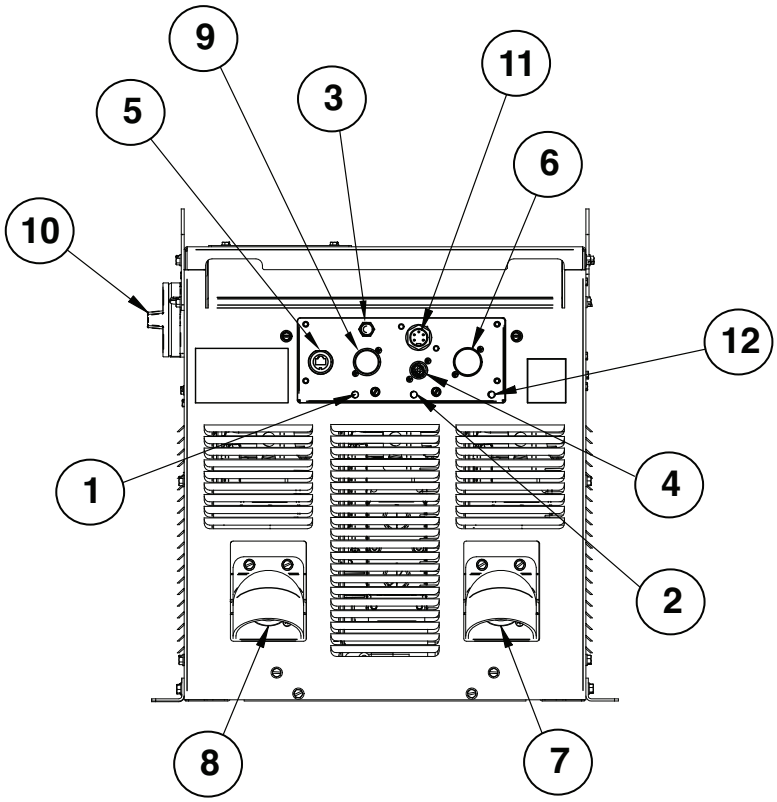
EQUIPMENT LIMITATIONS

The POWER WAVE® i400 is not directly compatible with analog machines or interfaces.

The input power pass-through connection (Terminal Block - 4TB) of the POWER WAVE® i400 is intended to supply power exclusively to the Fanuc R30iA controller. It is designed to support a 3kW maximum robot controller load through cable provided with the K2677-1 Integration Kit.

Return to Section TOC
Return to Master TOC

FIGURE B.1 RIGHT SIDE



RIGHT SIDE COMPONENTS

1. **Machine Status Indicator:** A two color LED that indicates system errors. The POWER WAVE® i400 is equipped with two indicators. One is for the inverter power source, while the other indicates the status of the feeder control system. Normal operation is a steady green light. Error conditions are indicated, per table below.

NOTE: The POWER WAVE® i400 status light will flash green, and sometimes red and green, for up to one minute when the machine is first turned on. This is a normal situation as the machine goes through a self test at power up

Light Condition	Meaning
Steady Green	System is okay. Power source communicating normally with the wire feeder and its components.
Blinking Green	Occurs during a reset and indicates the POWER WAVE® i400 is mapping (identifying) each component in the system. Normally this occurs for the first 1-10 seconds after power is turned on or if the system configuration is changed during operation.
Alternating Green and Red	Non-recoverable system fault. Errors are present in the POWER WAVE® i400. Read the error code before the machine is turned off.
	Error code interpretation through the Status light is detailed in the ***Trouble Shooting section***. Individual code digits are flashed in red with a long pause between digits. If more than one code is present, the codes will be separated by a green light.
	To clear the error, turn power source off, and back on to reset. See ***Troubleshooting section***.
Steady Red	Not applicable
Blinking Red	Not applicable

Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC

Return to Section TOC
Return to Master TOC

2. THERMAL INDICATOR (THERMAL OVERLOAD): A yellow light that comes on when an over temperature situation occurs. Output is disabled and the fan continues to run, until the machine cools down. When cool, the light goes out and output is enabled.

3. CIRCUIT BREAKER (CB1 - 15 AMP): Protects the 40 volt DC supply for the feeder and machine controls.

4. VOLTAGE SENSE CONNECTOR: Allows for separate remote electrode and work sense leads.

Pin	Lead	Function
3	21	Work Voltage Sense
1	67C	Electrode Voltage Sense

5. ETHERNET CONNECTOR (RJ-45): Used for ArcLink® XT communication. Also used for diagnostics and reprogramming the POWER WAVE® i400.

Pin	Function
1	Transmit +
2	Transmit -
3	Receive +
4	---
5	---
6	Receive -
7	---
8	---

6. **WIRE FEEDER RECEPTACLE (14-PIN):** For connection to the Auto Drive 4R90 and Power Feed 10R wire feeders.

Pin	Lead	Function
A	539	Motor +
B	541	Motor -
C	521	Solenoid +
D	522	Solenoid Common
E	845	Tach 2A differential signal
F	847	Single Tach input
G	841	+15V Tach supply
H	844	Tach common
I	Open	Reserved for future use
J	GND	Shielding drain
K	842	Tach 1A differential signal
L	843	Tach 1B differential signal
M	846	Tach 2B differential signal
N	67A	Electrode Sense (67)

7. NEGATIVE OUTPUT TERMINAL

8. POSITIVE OUTPUT TERMINAL

9. ARCLINK® RECEPTACLE:

Pin	Lead	Function
A	153	Communication Bus L
B	154	Communication Bus H
C	67	Electrode Voltage Sense
D	52	+40V DC
E	51	0 VDC

10. ON / OFF SWITCH: Controls input power to the POWER WAVE® i400, and when properly integrated, the Fanuc R30iA Controller.

⚠ WARNING

The POWER WAVE® i400 ON/OFF switch is NOT intended as a Service Disconnect for this equipment.

---

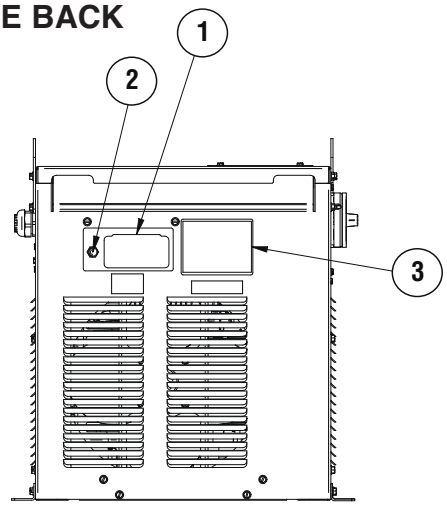
11. DEVICENET CONNECTOR (5 PIN - "MINI" STYLE):

Pin	Lead	Function
2	894	+24 VDC DeviceNet
3	893	Common DeviceNet
4	892	DeviceNet H
5	891	DeviceNet L

12. FEEDER STATUS INDICATOR(See *Item 1*)

FIGURE B.2

CASE BACK



CASE BACK COMPONENTS DESCRIPTION

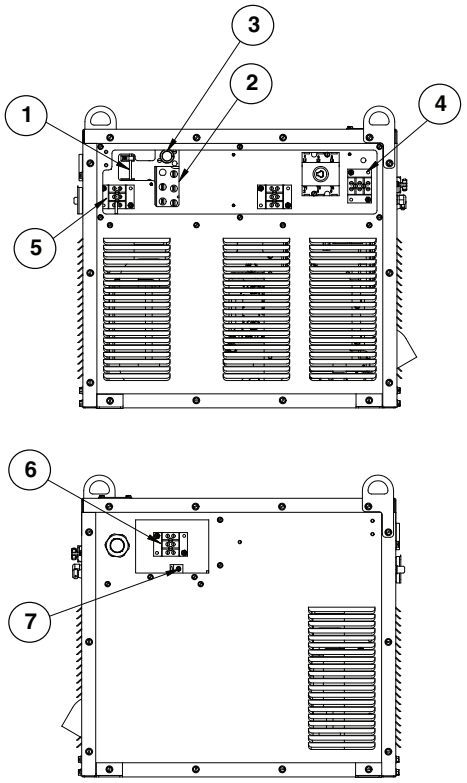
1. 115V / 15A DUPLEX RECEPTACLE

2. CIRCUIT BREAKER (CB2 - 15 AMP): Provides protection for the 115V auxiliary.

3. RATING PLATE

INTERNAL CONTROLS

FIGURE B.3



INTERNAL CONTROLS DESCRIPTION

1. **MAIN RECONNECT:** Selects main capacitor configuration for 208-230V or 380-575V input.

2. **AUXILIARY RECONNECT:** Configures auxiliary power for specified input voltage (208/230/380/460/575V).

3. **FUSE (F1):** Primary circuit protection for auxiliary power (10A/600V).

4. **ROBOT POWER TERMINAL BLOCK (4TB):** Power supply connection for Fanuc R30iA controller. Supplies primary power through the ON/OFF switch directly to the robot controller.

⚠ CAUTION

This input power pass-through connection is intended to supply power exclusively to the Fanuc R30iA controller. It is designed to support a 3kW maximum robot controller load through cable provided with the K2677-1 Integration Kit.

---

5. **CHASSIS POWER TERMINAL BLOCK (3TB):** Power connection for internal chassis. Provides power for the inverter and all auxiliary supplies.

6. **INPUT POWER TERMINAL BLOCK (1TB):** Input power connection from main service disconnect.

7. **GROUND TERMINAL:** Earth ground connection.

8. **PC BOARD DIPSWITCHES (NOT SHOWN):** PC Board dip switches are set at the factory to allow configuration of the POWER WAVE® i400 via the Fanuc Teach Pendant or with the Diagnostics Utility (included on the POWER WAVE® Utilities and Service Navigator CD's or available at www.powerwavesoftware.com). The factory default settings are as follows:

Control Board (G4800 Series Hardware):

- $S1_{large}$ = OFF
- $S2_{small}$ = ON

Feed Head Board (L11087 Series Hardware):

- $S1_{1\ thru\ 8}$ = OFF

POWER-UP SEQUENCE

The POWER WAVE® i400 will typically be powered up at the same time as the robotic controller. The status lights will blink green for about a minute while the system is configuring. After this time, the status lights will turn a steady green indicating the machine is ready.

DUTY CYCLE

The POWER WAVE® i400 is rated at 350 amps at 32 volts with a 100% duty cycle. It is further rated to provide 400 amps at 36 volts with a 60% duty cycle and 420 amps at 37 volts with a 40% duty cycle. The duty cycle is based on a ten-minute period. A 60% duty cycle represents 6 minutes of welding and 4 minutes of idling in a ten-minute period.

COMMON WELDING PROCEDURES

⚠ WARNING

MAKING A WELD

The serviceability of a product or structure utilizing the welding programs is and must be the sole responsibility of the builder/user. Many variables beyond the control of The Lincoln Electric Company affect the results obtained in applying these programs. These variables include, but are not limited to, welding procedure, plate chemistry and temperature, weldment design, fabrication methods and service requirements. The available range of a welding program may not be suitable for all applications, and the build/user is and must be solely responsible for welding program selection.

Return to Section TOC
Return to Master TOC

Return to Section TOC
Return to Master TOC

Choose the electrode material, electrode size, shielding gas, and process (GMAW, GMAW-P etc.) appropriate for the material to be welded.

Select the weld mode that best matches the desired welding process. The standard weld set shipped with the POWER WAVE® i400 encompasses a wide range of common processes that will meet most needs. If a special weld mode is desired, contact the local Lincoln Electric sales representative.

To make a weld, the POWER WAVE® i400 needs to know the desired welding parameters. The robot controller sends the parameters from the teach pendant (arc voltage, wire feed speed, arc control, etc.), to the POWER WAVE® i400 via the ArcLink® communication protocol over the control or Ethernet cable.

DEFINITIONS OF WELDING MODES

NON-SYNERGIC WELDING MODES

- A **Non-synergic** welding mode requires all welding process variables to be set by the operator.

SYNERGIC WELDING MODES

- A **Synergic** welding mode offers the simplicity of single knob control. The machine will select the correct voltage and amperage based on the wire feed speed (WFS) set by the operator.

BASIC WELDING CONTROLS

Weld Mode
Selecting a weld mode determines the output characteristics of the POWER WAVE® power source. Weld modes are developed with a specific electrode material, electrode size, and shielding gas. For a more complete description of the weld modes programmed into the POWER WAVE® at the factory, refer to the Weld Set Reference Guide supplied with the machine or available at www.powerwavesoftware.com.

Wire Feed Speed (WFS)
In synergic welding modes (synergic CV, GMAW-P), WFS is the dominant control parameter. The user adjusts WFS according to factors such as wire size, penetration requirements, heat input, etc. The POWER WAVE® then uses the WFS setting to adjust the voltage and current according to settings contained in the POWER WAVE®.

In non-synergic modes, the WFS control behaves like a conventional power source where WFS and voltage are independent adjustments. Therefore, to maintain proper arc characteristics, the operator must adjust the voltage to compensate for any changes made to the WFS.

Volts
In constant voltage modes, this control adjusts the welding voltage.

Trim
In pulse synergic welding modes, the Trim setting adjusts the arc length. Trim is adjustable from 0.50 to 1.50. 1.00 is the nominal setting and is a good starting point for most conditions.

Arc Control
Also known as Wave Control, Arc Control allows the operator to vary the arc characteristics from “soft” to “crisp”. Arc Control is adjustable from –10.0 to +10.0 with a nominal setting of 0.0.

CONSTANT VOLTAGE WELDING

Synergic CV
In synergic welding modes, WFS is the dominant control parameter. For each wire feed speed, a corresponding voltage is programmed into the machine at the factory. The user adjusts WFS according to factors such as wire size, material thickness, penetration requirements, etc. The POWER WAVE® then uses the WFS setting to select the appropriate voltage. The voltage selected will be a nominal voltage. The user can adjust the voltage higher or lower to compensate for material condition or individual preference.

Non Synergic CV
In non-synergic modes, the machine behaves like a conventional power source. The WFS and voltage are independent adjustments. Therefore, to maintain the arc characteristics, the operator must adjust the voltage to compensate for any changes made to the WFS.

Arc Control (For All CV Modes)
Arc Control is also know as wave control. Arc Control adjusts the apparent inductance of the wave shape. The Arc Control adjustment is similar to a “pinch” function in that it is inversely proportional to inductance. Arc Control is adjustable from –10.0 to +10.0 with a nominal setting of 0. Increasing Arc Control results in a crisper, hotter arc. Decreasing the wave control provides a softer, colder arc.

Pulse Welding

When pulse welding, the power source primarily regulates the arc current, not the arc voltage. During a pulsing cycle, arc current is regulated from a low background level to a high peak level and then back down to the low background level. The average arc voltage increases and decreases as the average arc current is increased or decreased. The peak current, back ground current, rise time, fall time and pulse frequency all affect the average voltage. Since the average voltage for a given wire feed speed can only be determined when all the pulsing waveform parameters are known, a unitless value called “trim” is used for adjusting the arc length. Trim adjusts the arc length and ranges from 0.50 to 1.50 with a nominal value of 1.00. Increasing the trim value increases the arc length. Decreasing the trim value decreases the arc length.

Pulse welding modes are synergic; using wire feed speed as the main control parameter. As the wire feed speed is adjusted, the power source adjusts the waveform parameters to maintain good welding characteristics. Trim is used as a secondary control to change the arc length for material conditions or individual preference.

Arc control, also referred to as wave control, adjusts the focus or shape of the arc. Arc Control is adjustable from -10.0 to +10.0 with a nominal setting of 0.0. Increasing the arc control increases the pulse frequency and background current while decreasing the peak current. This results in a tight, stiff arc used for high speed sheet metal welding. Decreasing the arc control decreases the pulse frequency and background current while increasing the peak current. This results in a soft arc good for out of position welding.

The POWER WAVE® utilizes adaptive control to compensate for changes in the electrical stick-out(distance from the contact tip to the work piece) while welding. The POWER WAVE® waveforms are optimized for a 5/8” to 3/4” stick out depending on the wire type and wire feed speed. The adaptive behavior supports a range of stick outs from approximately 1/2” to 1-1/4”. At low or high wire feed speeds, the adaptive range may be less due to physical limitations of the welding process.

Return to Section TOC
Return to Master TOC

NOTES

Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC

TABLE OF CONTENTS - ACCESSORIES SECTION

Return to Master TOC

Return to Master TOC

Return to Master TOC

Return to Master TOC

OPTIONAL EQUIPMENT

FACTORY INSTALLED

None Available.

FIELD INSTALLED

K940-Work Voltage Sense Lead Kit

K2670-[ ] CE Filter Kit
K2677-1 Integration Kit

K2780-1 POWERWAVE i400 Devicenet Kit
K2781-1 POWERWAVE i400 Sync-Tandem Kit

COMPATIBLE LINCOLN EQUIPMENT

K2685-2 Auto Drive 4R90 Wire feeder (14-pin control cable).
K1780-2 Power Feed 10 Robotic Wire Drive

For additional Information see Optional Equipment in the Installation Section.

Return to Section TOC
Return to Master TOC

TABLE OF CONTENTS - MAINTENANCE SECTION

Return to Master TOC
Return to Master TOC
Return to Master TOC
Return to Master TOC

Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC

SAFETY PRECAUTIONS

⚠ WARNING

ELECTRIC SHOCK can kill.
- **Do not touch electrically live parts or electrode with skin or wet clothing.**
- **Insulate yourself from work and ground**
- **Always wear dry insulating gloves.**

EXPLODING PARTS can cause injury.

- **Failed parts can explode or cause other parts to explode when power is applied.**
- **Always wear a face shield and long sleeves when servicing.**

See additional warning information throughout this Operator's Manual

ROUTINE MAINTENANCE

Routine maintenance consists of periodically blowing out the machine, using a low pressure airstream, to remove accumulated dust and dirt from the intake and outlet louvers, and the cooling channels in the machine.

PERIODIC MAINTENANCE

Calibration of the POWER WAVE® i400 is critical to its operation. Generally speaking the calibration will not need adjustment. However, neglected or improperly calibrated machines may not yield satisfactory weld performance. To ensure optimal performance, the calibration of output Voltage and Current should be checked yearly.

CALIBRATION SPECIFICATION

Output Voltage and Current are calibrated at the factory. Generally speaking the machine calibration will not need adjustment. However, if the weld performance changes, or the yearly calibration check reveals a problem, use the calibration section of the Diagnostics Utility to make the appropriate adjustments.

The calibration procedure itself requires the use of a grid, and certified actual meters for voltage and current. The accuracy of the calibration will be directly affected by the accuracy of the measuring equipment you use. The Diagnostics Utility includes detailed instructions, and is available on the POWER WAVE® Utilities and Service Navigator DVD's or available at www.powerwavesoftware.com.

CHASSIS REMOVAL PROCEDURE

⚠ WARNING

ELECTRIC SHOCK can kill.
- **Disconnect input power before servicing.**
- **Do not operate with covers removed.**
- **Do not touch electrically live parts.**
- **Only qualified persons should install, use or service this equipment.**

(See Figure D.1)

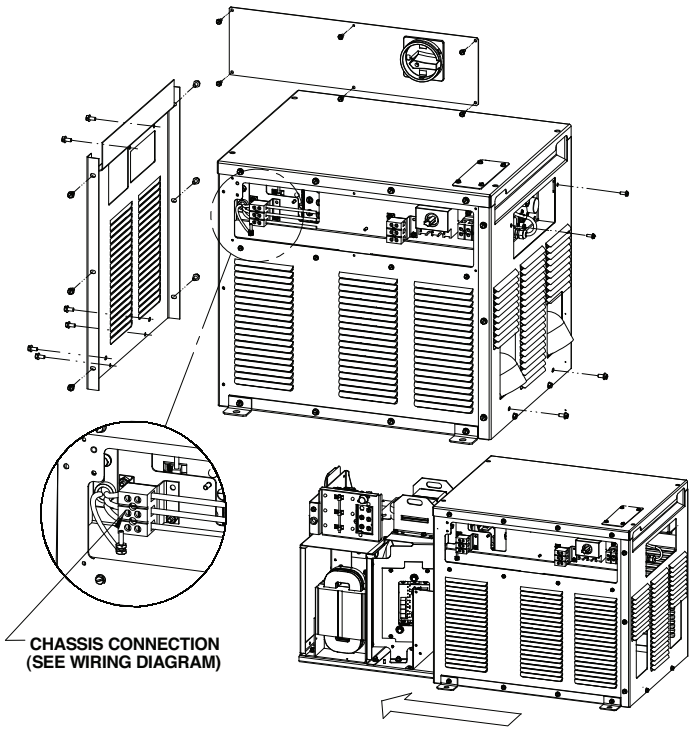
1. Turn off input power to the power source and any other equipment connected to the welding system at the disconnect switch or fuse box before working on the equipment.

2. Remove the weld cables from the output studs, and disconnect all control cables including the Ethernet connection from the control panel.

3. Remove the screws securing the chassis to the cabinet as listed below:

   - (6) 10-24 screws securing the reconnect access panel on the front of the machine (ON/OFF switch must be in the OFF position for removal).
   - (2) 1/4-20 screws on either side of the control panel located on the right case side.
   - (2) 1/4-20 screws just below the output studs located on the right case side.
   - (12) 1/4-20 screws from the left case side.

FIGURE D.1



4. Remove the left case side by pulling out from the bottom.

5. Disconnect the chassis input power leads (1E, 2E & 3E) from terminal block "3TB" located in the cabinet reconnect area, and remove the chassis ground from the stud located in front the terminal block.

6. Carefully slide the chassis from the cabinet by pulling on the fan bracket. (see ***Location and Mounting*** section of this document for instructions on lifting the chassis).

CAPACITOR DISCHARGE PROCEDURE

⚠ CAUTION

• Prior to transporting or servicing chassis it is important to verify the capacitors are completely discharged.

---

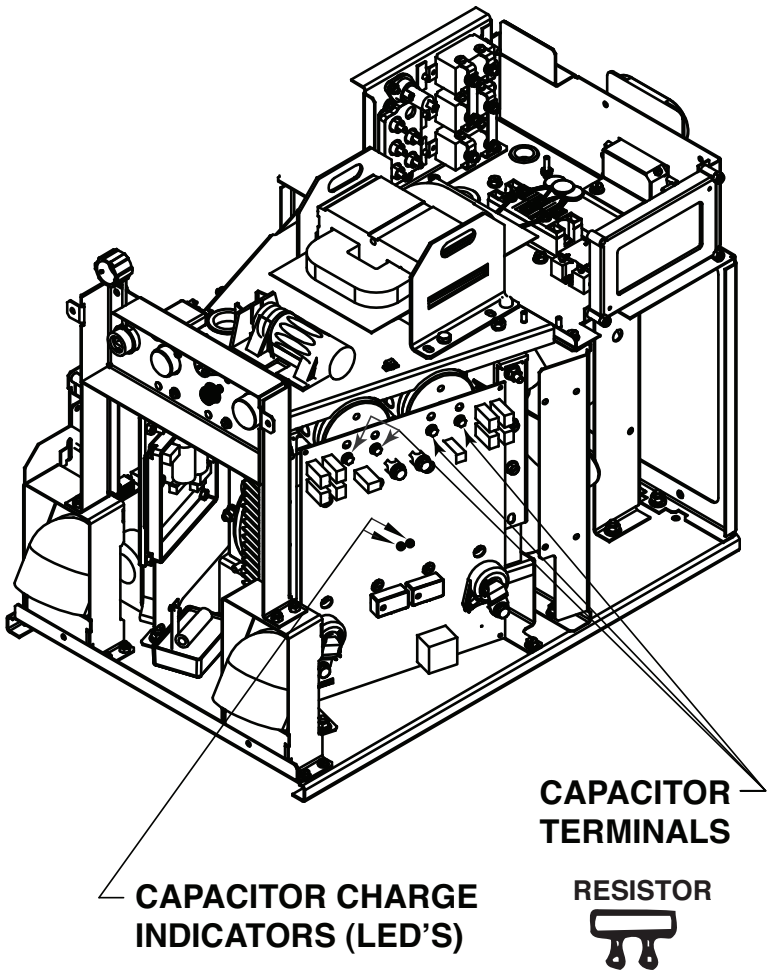
1. Use a DC voltmeter to check that NO voltage is present across the terminals of both capacitors.

   Note: Presence of capacitor voltage is also indicated by LED's (See figure D.1a)

2. If voltage is present wait for capacitors to completely discharge (this may take several minutes) or discharge the capacitors as follows:

   - Obtain a power resistor (25 ohms, 25 watts).
   - Hold resistor body with electrically insulated glove. DO NOT TOUCH RESISTOR TERMINALS. Connect the resistor terminals across the two capacitor terminals in the position shown. Hold in each position for 10 seconds. Repeat for the other capacitor.
   - Use a DC voltmeter to check that voltage is not present across the terminals of both capacitors.

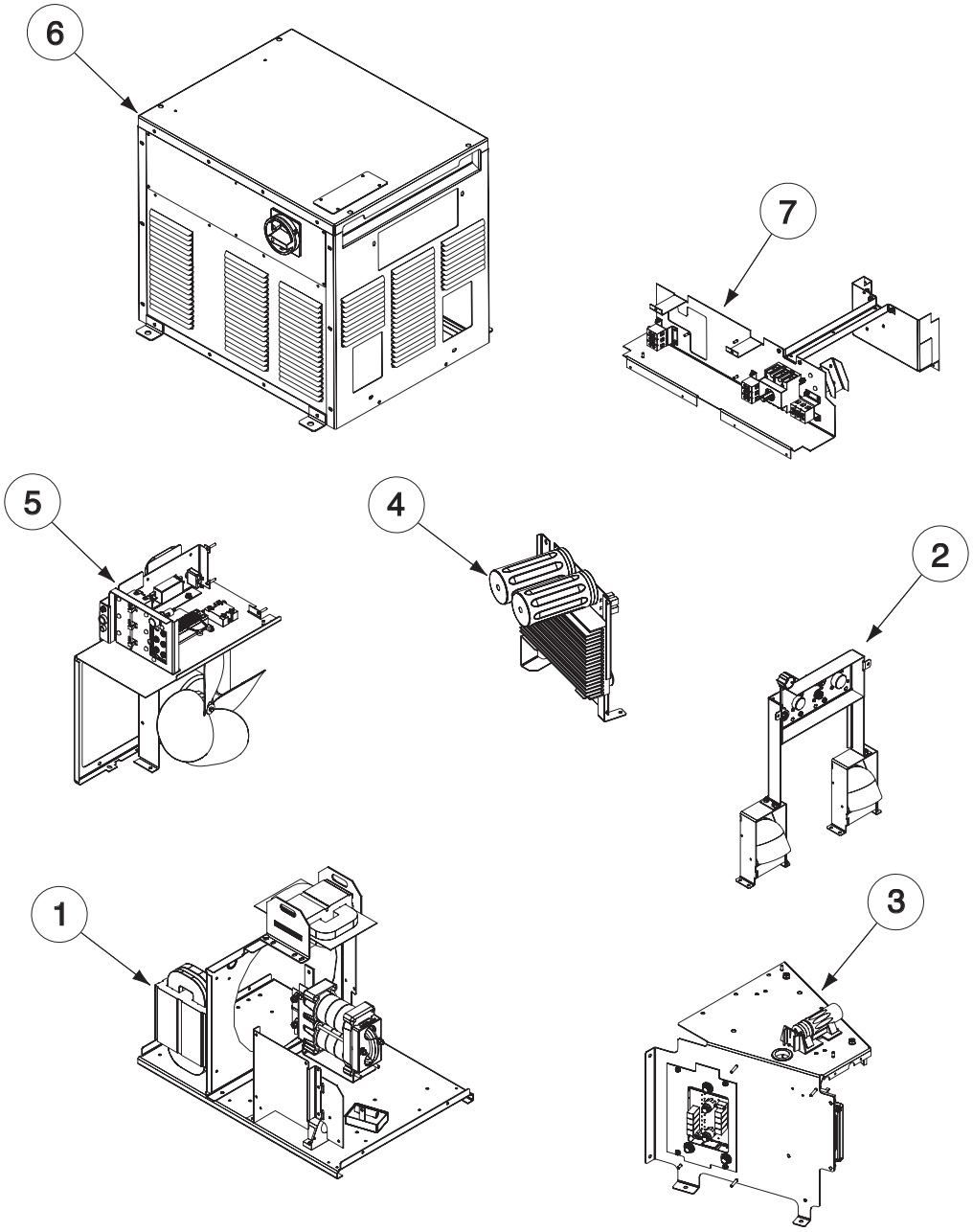
FIGURE D.1a



Return to Section TOC
Return to Master TOC

1. Chassis Assembly
2. Stud Connection & Connection Panel Assemblies
3. Center Chassis Support Assembly
4. Switchboard Assembly
5. Fan & Fan Surround Assembly
6. Case & Front Access Panel Assemblies
7. Electrical Connection Box & Input Box Assemblies

Figure D.2 - Major Component Locations



Return to Section TOC
Return to Master TOC

TABLE OF CONTENTS-THEORY OF OPERATION SECTION

Return to Master TOC

Return to Master TOC

Return to Master TOC

FIGURE E.1 BLOCK LOGIC DIAGRAM

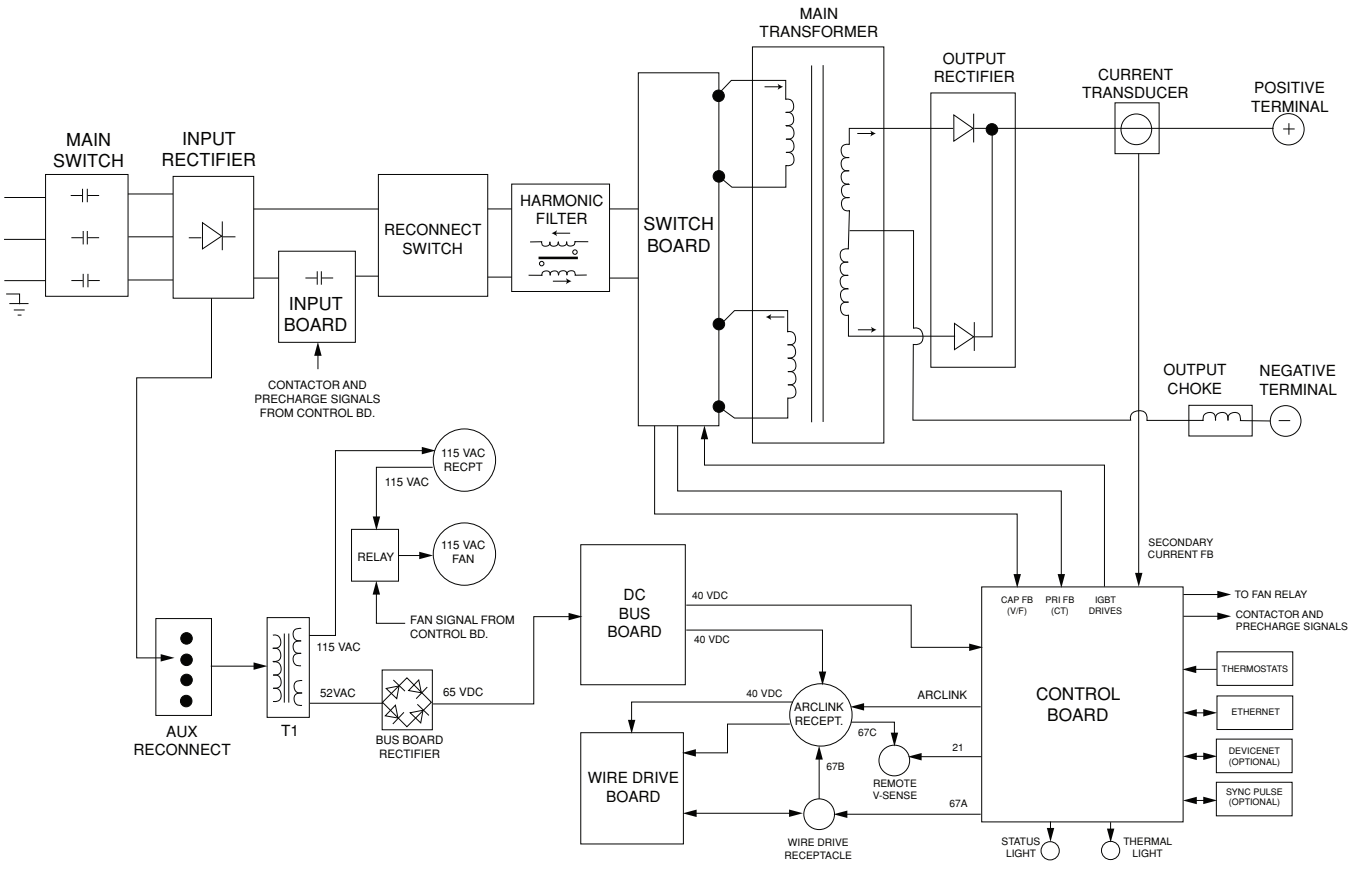
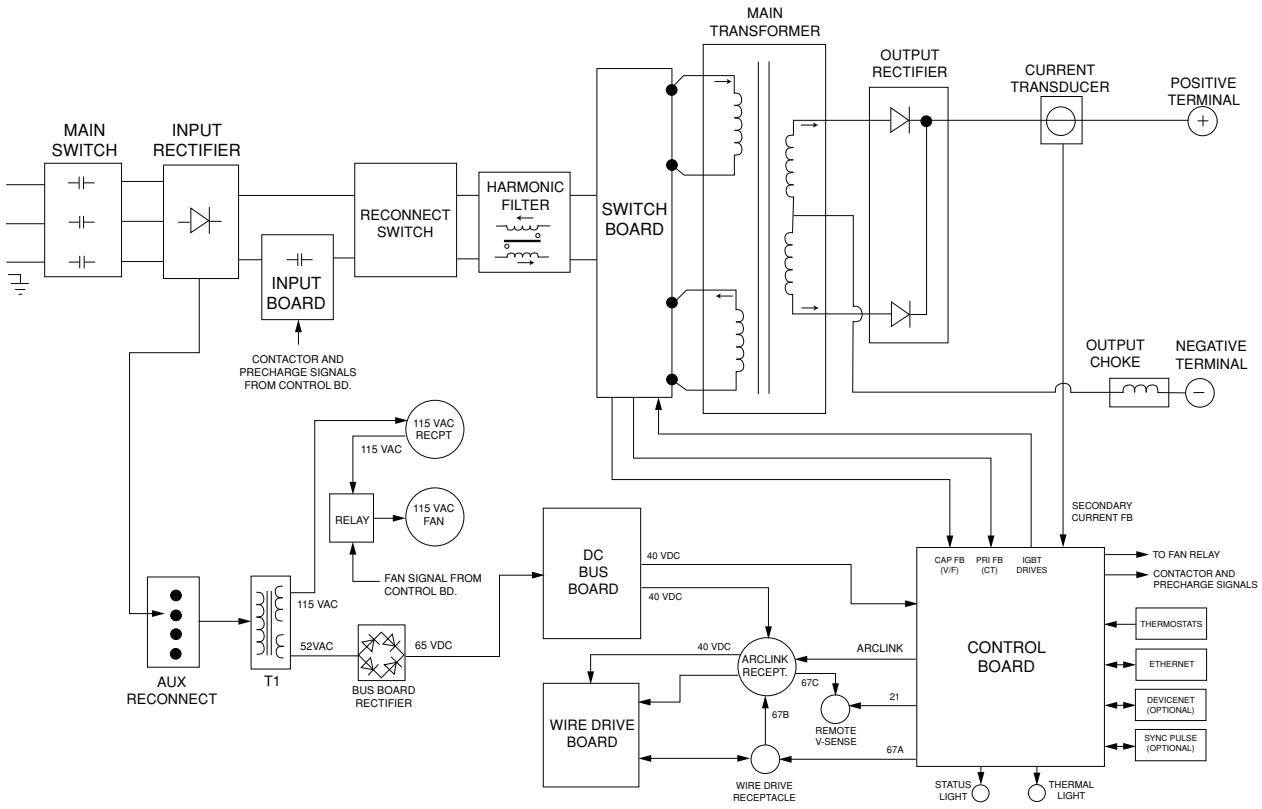


FIGURE E.2 - GENERAL DESCRIPTION



GENERAL DESCRIPTION

The Power Wave i400 machine is a high performance, multi-process, digitally controlled inverter power source. It is designed as a pedestal to support the Fanuc R30iA controller. The i400 includes an innovative new case design featuring a removable slide mounted power section for ease of service. It may also be utilized with other controllers as a stand alone power source.

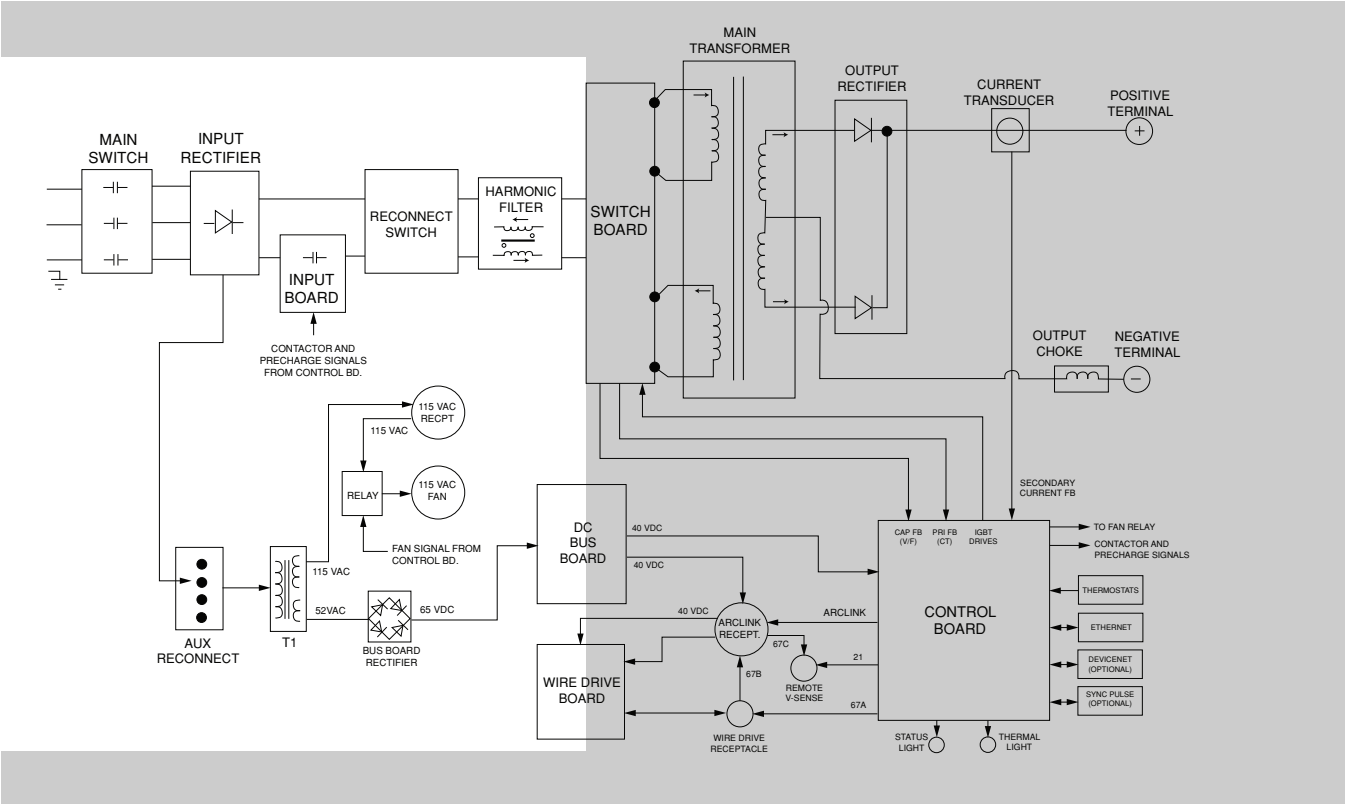
The i400 is capable of producing a welding output from 5 to 420 amperes and at 350 amps has the capability of a 100% duty cycle. This unit utilizes the latest generation high speed digital controls and communicates via ArcLink XT to the Fanuc controller. The inverter power section utilizes state of the art power electronics and is re-connectable for 3 phase input voltages from 208 to 575VAC. A 15 Amp auxiliary receptacle is provided for fume extraction and water cooler accessories. When equipped with a K2670-1 CE Filter Kit the Power Wave i400 is fully CE compatible.

Note: The K2669-2 machine is configured for an input voltage of 200-208VAC only and does not have a reconnect panel for other input voltages. Also, the above mentioned CE Filter Kit is NOT compatible with the K2669-2 i400 machine.

NOTE: Unshaded areas of Block Logic Diagram are the subject of discussion

Return to Section TOC
Return to Master TOC

FIGURE E.3 - INPUT VOLTAGE, RECTIFICATION, PRECHARGE (SOFT-START) & FILTERING



INPUT VOLTAGE, RECTIFICATION, PRECHARGE (soft-start) & FILTERING

The Power Wave i400 can be connected for a variety of three-phase input voltages. The initial input power is applied through a line switch located in the cabinet (not on the chassis). Reference the Main Switch noted on the block diagram. Two phases of the AC three-phase input power are applied to the T1 auxiliary transformer via a fuse and reconnect jumper lead. The two secondary voltages developed by the T1 transformer are applied to the 115VAC accessory receptacle, the fan motor (via a control relay) and to the Bus Board Rectifier.

The 65VDC produced by the Bus Board Rectifier is used by the Bus Board to provide 40VDC regulated voltage to the Control Board, the ArcLink Receptacle, and the Wire Drive Board.

The input rectifier receives the three-phase AC input voltages and rectifies them into a DC voltage. This DC voltage is applied to the Input Board and Reconnect Switch. During precharge the Input Board provides a “soft start” function that limits the inrush current to the Main Capacitors located on the main switch board. A voltage to frequency circuit on the Main Switch Board sends a signal to the Control Board. When the capacitors have charged to an acceptable level the Control Board signals the Input Board to energize the main input contactor. The main input contactor is a board mounted relay group located on the Input Board. At this point in time the i400 is in the run mode of operation. If the main capacitors become undervoltaged, overvoltaged, or unbalanced the Control Board will signal the Input Board to de-energize the Main Input Contactor and the Power Wave i400 will be disabled.

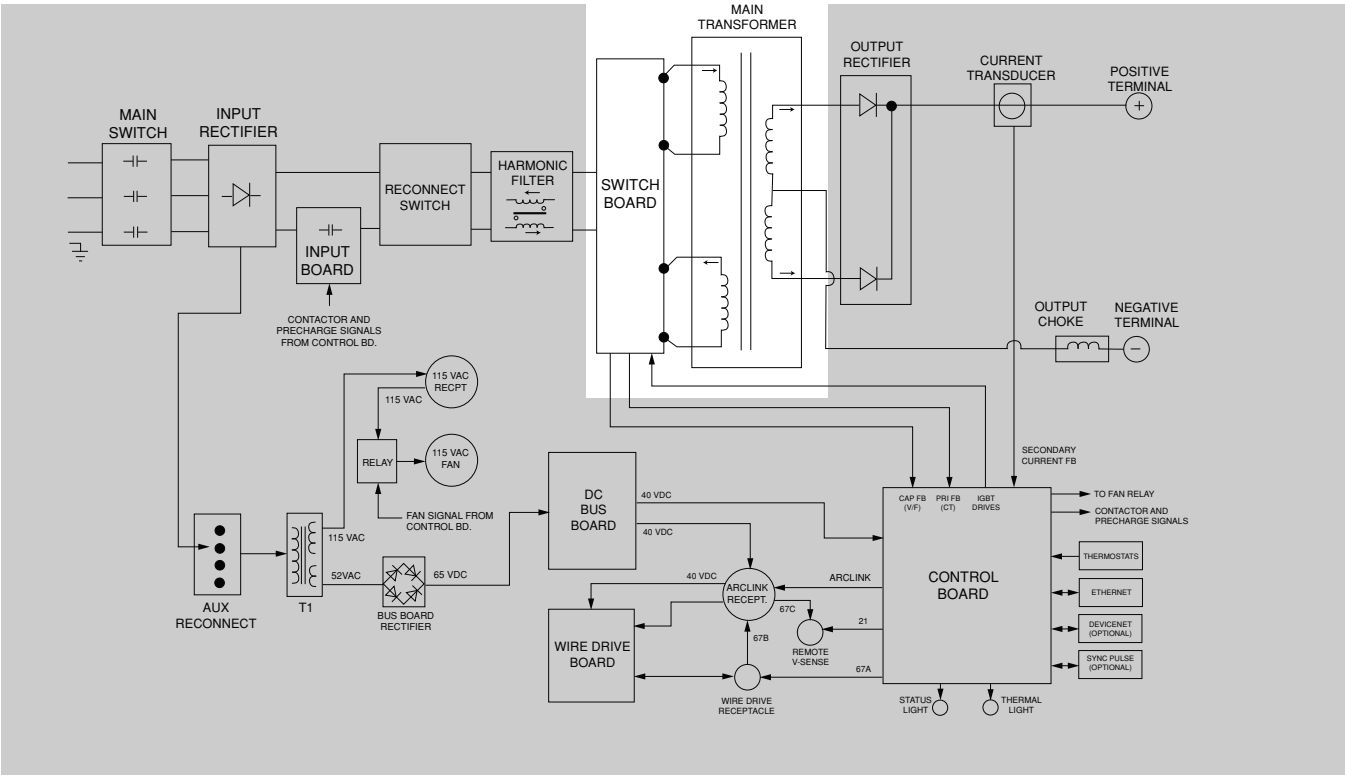
The Reconnect Switch must be in the correct position for the input voltage being applied to the i400. It configures the Main Input Capacitors to be either in series or parallel to properly accept the rectified input voltage.

The Harmonic Filter passively corrects the power factor to 95%. It also reduces the input current and reduces harmonic distortion.

NOTE: Unshaded areas of Block Logic Diagram are the subject of discussion

Return to Section TOC
Return to Master TOC

FIGURE E.4 - MAIN SWITCH BOARD & MAIN TRANSFORMER



MAIN SWITCH BOARD & MAIN TRANSFORMER

There is one Main Switch Board in the Power Wave i400 machine. It converts rectified 60Hz. input to high frequency output. The single Switch Board is comprised of two separate switch groups. The board houses two input capacitors and insulated bipolar transistor (IGBT) switching circuitry. One switch group for each Main Transformer primary coil.

The IGBTs switch the DC power from the input capacitors “on and off”, thus supplying a pulsed DC current to the main transformer primary windings. See IGBT Operation Discussion and Diagrams in this section.

Each switch group feeds current to separate, oppositely wound primary coils in the Main Transformer. The reverse directions of current flow through the primary winding and offset timing of the IGBT switching circuits induce an AC square wave output voltage at the secondary of the Main Transformer. Current transformers (CTs) monitor the primary currents. If the primary currents become abnormally high, the Control Board will shut off the IGBTs, thus disabling the machine’s output.

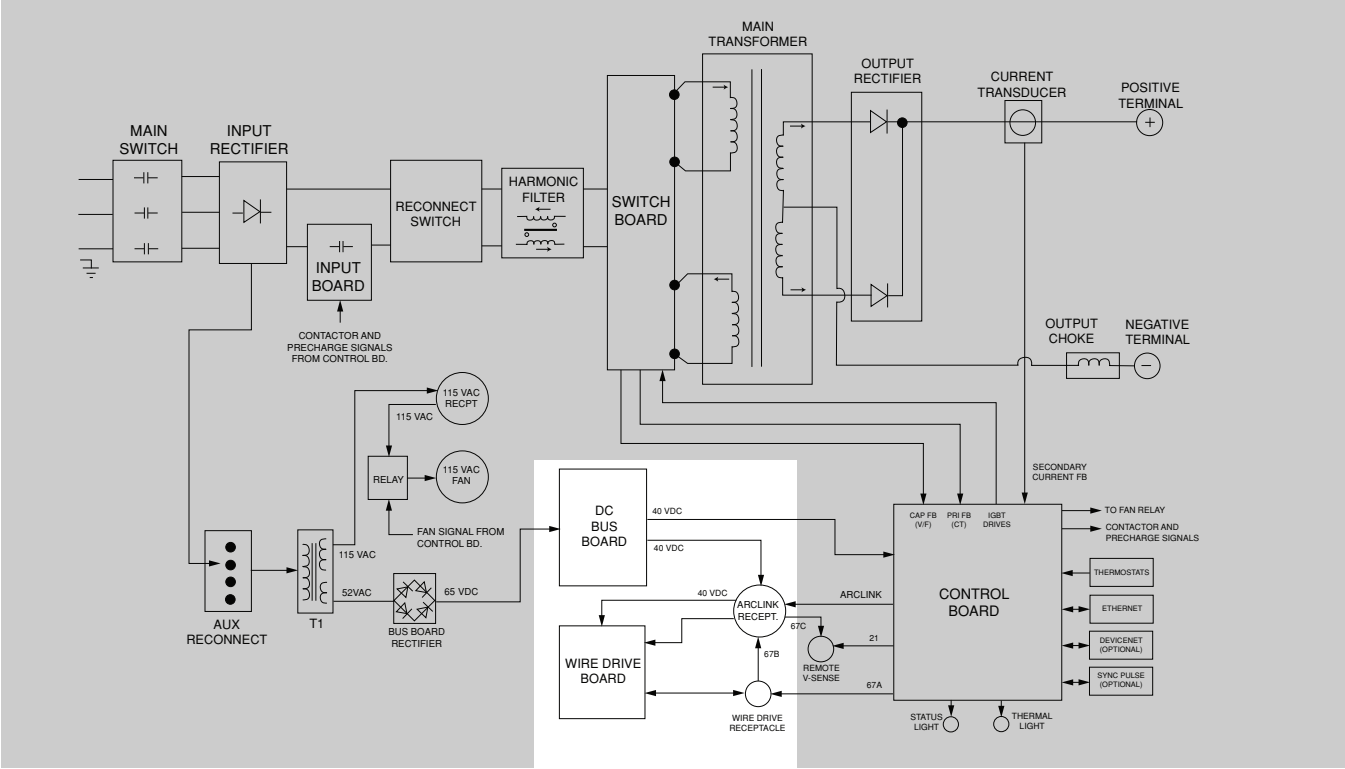
The DC current flow through each primary winding is clamped back to each respective input capacitor when the IGBTs are turned off. This is needed due to the inductance of the transformer primary windings. The firing of the two switch board groups occurs during halves of a 16.6 microsecond interval, creating a constant 60 KHz output at the secondary. (full wave rectified to 120 KHz.) See ***Pulse Width Modulation*** discussion in this section.

The Main Transformer is a coaxial transformer. Coaxial refers to the orientation of the transformer windings. The secondary conductors are oriented in a tubular fashion with each layer or turn completely encompassing the previous. The primary conductors are wound through the tubular secondary. This tunnel effect provides tighter magnetic coupling between conductors resulting in lower leakage inductance, higher efficiency, cooler operation and reduced stress on the drive components. (IGBTs)

NOTE: Unshaded areas of Block Logic Diagram are the subject of discussion

Return to Section TOC
Return to Master TOC

FIGURE E.5 - DC BUS BOARD,WIRE DRIVE BOARD, ARCLINK & WIRE DRIVE RECEPTACLES



DC BUS BOARD, WIRE DRIVE BOARD, ARCLINK RECEPTACLE & WIRE DRIVE RECEPTACLE

The DC Bus Board receives approximately 65VDC from the bus board rectifier. The DC Bus Board regulates that 65VDC into a 40 DC supply. This regulated 40VDC supply is applied to the Control Board, the ArcLink receptacle and the Wire Drive Board.

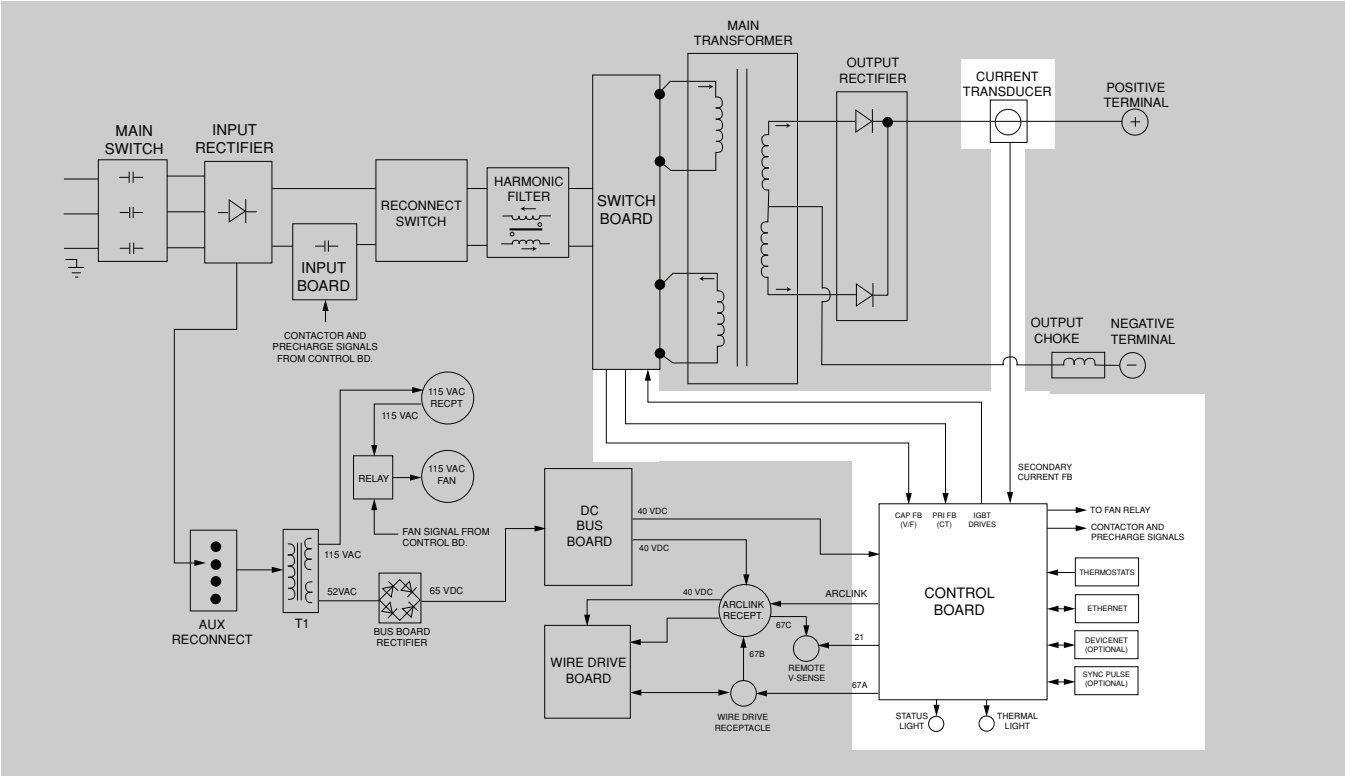
The Wire Drive Board utilizes the 40DC supplied from the Bus Board to develop a +15VDC supply and a -15VDC supply. It also develops a +5VDC supply. These supplies are used to operate the logic controlling the gas solenoid, the wire drive motor, the tach circuitry and the electronics on the PC board. The gas solenoid and the wire drive motor power are sourced directly from the 40VDC bus and are pulse width modulated outputs. These functions are connected to the external wire drive via the wire drive receptacle.

The ArcLink receptacle is used to communicate ArcLink protocol between the Control Board, the Wire Drive Board and external entities. It also provides an external connection for 40VDC and voltage sensing.

The Ethernet Receptacle is being used for ArcLink XT which, in most applications, is the primary ArcLink interface for the Fanuc Controller.

NOTE: Unshaded areas of Block Logic Diagram are the subject of discussion

FIGURE E.6 - CONTROL BOARD



CONTROL BOARD

The Control Board performs the primary interfacing functions to establish and maintain output control of the Power Wave i400 machine. The function generator and weld files exist within the Control Board hardware and software. Digital command signals, arc voltage and current feedback information are received and processed by software located on the Control Board. The appropriate pulse width modulation (PWM) signals are then sent to the gates of the Switch Board IGBTs to create the high-speed, digitally controlled welding waveform. (See ***Pulse Width Modulation*** discussion in this section).

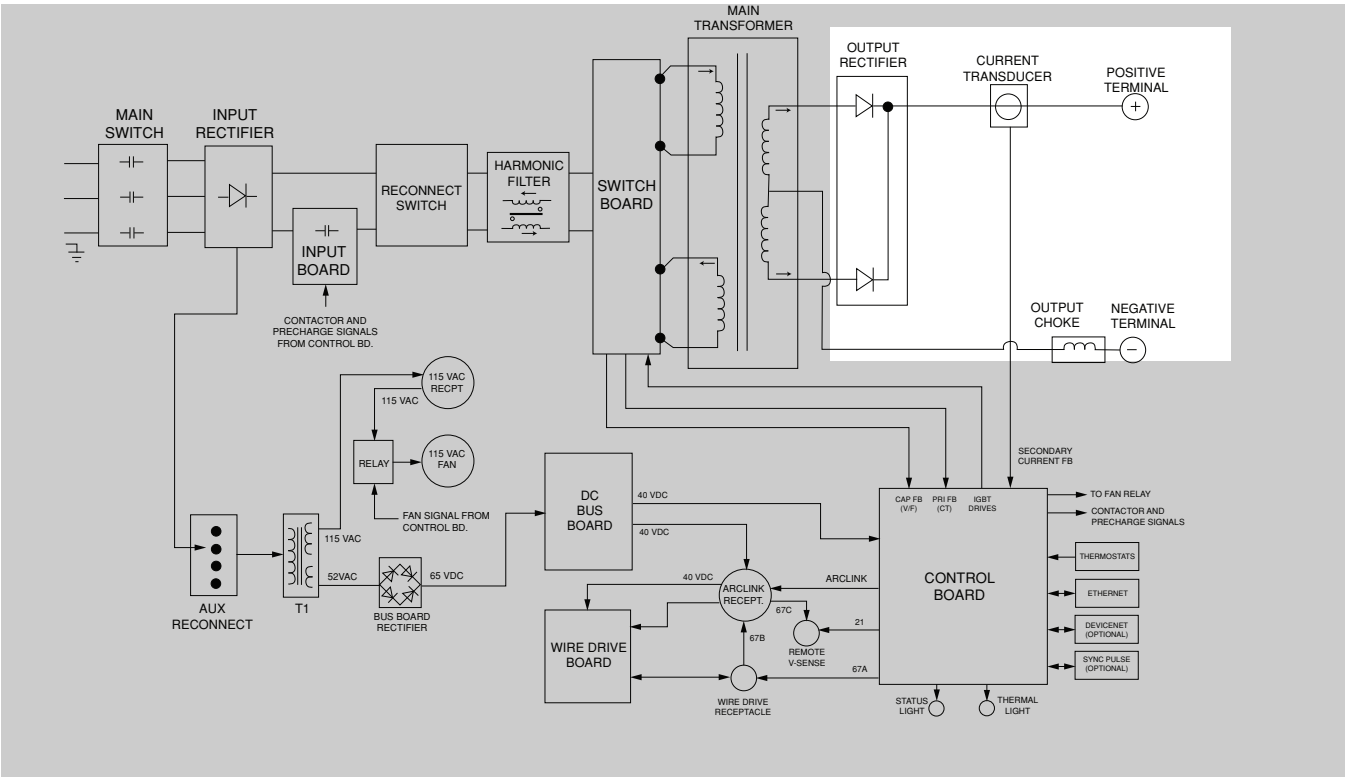
In addition, the Control Board monitors the thermostats, the main transformer primary currents, the input filter capacitor voltages and commands the soft-start contactor, main input contactor and fan relay. Depending on the fault condition, the Control Board will activate the thermal and/or the status light and will either disable or reduce the machine output. In some conditions the input contactor will be de-energized.

The Control Board also serves as the main communication interface with ArcLink, Ethernet and/or Devicenet.

NOTE: Unshaded areas of Block Logic Diagram are the subject of discussion

Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC

FIGURE E.7 - OUTPUT RECTIFIER, OUTPUT CHOKE & CURRENT TRANSDUCER



OUTPUT RECTIFIER, OUTPUT CHOKE & CURRENT TRANSDUCER

The Output Rectifier receives the AC output from the main transformer secondary and rectifies it to a DC voltage level. The 60kHz AC applied to the Output Rectifier is full wave rectified thus, a DC output at 120kHz (ripple frequency) is applied through the Output Choke to the welding terminals. The Output Choke is in series with the negative leg of the output rectifier and also in series with the welding load. Due to the current "smoothing" capabilities of the output choke, a filtered DC output current is applied through the machine output terminals to the welding arc.

The Current Transducer monitors the output current and converts that information into a low voltage signal that is sent to the Control Board. (500 Amps = 4.0VDC). The Control Board uses this current feedback information along with output voltage information to monitor and control the output of the machine.

NOTE: Unshaded areas of Block Logic Diagram are the subject of discussion

Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC

MACHINE PROTECTION

THERMAL PROTECTION

Four normally closed (NC) thermostats protect the machine from excessive operating temperatures. Three of the four thermostats are wired in series and connected to the control board. One of these thermostats is located on the heat sink of the Output Rectifier, one on the DC Bus Board, and one on the Output Choke. Excessive temperatures may be caused by a lack of cooling air or by operating the machine beyond its duty cycle or output rating. If excessive operating temperatures should occur, the thermostats will prevent output from the machine. The yellow thermal light, located on the front of the machine, will be illuminated. The thermostats are self-resetting once the machine cools sufficiently. If the thermostat shutdown was caused by excessive output or duty cycle and the fan is operating normally, the power switch may be left on and the reset should occur within a 15-minute period. If the fan is not turning or the intake air louvers are obstructed, the power must be removed from the machine and the fan condition or air obstruction corrected. The fourth thermostat is located on the Auxiliary transformer. If it opens the fan would turn on but the machine's output would ***not*** be disabled. This would be a normal occurrence with long 'idle' times.

PROTECTIVE CIRCUITS

Protective circuits are designed into the Power Wave i400 to sense trouble and shut down the machine before damage occurs to the machine's internal components. Error Codes will be flashed out by the Red/Green Status LED on the front panel and LEDs on
The Control Board will help identify the reason for the shutdown. See the ***Troubleshooting Section*** for more information regarding Error Codes. Fault codes can also be seen by using the Diagnostic Software. The LED associated with the Wire Drive Board provides indications of the wire drive status.

OVER CURRENT PROTECTION

If the average weld current exceeds 450 amps the machine's output will be disabled.

UNDER/OVER VOLTAGE PROTECTION

A protective circuit is included on the Control Board to monitor the voltage across the input capacitors. In the event that the capacitor voltage is too high, too low, or becomes unbalanced side-to-side, the protection circuit will de-energize the input contactor. Machine output will be disabled. The protection circuit will prevent output if any of the following circumstances occur.

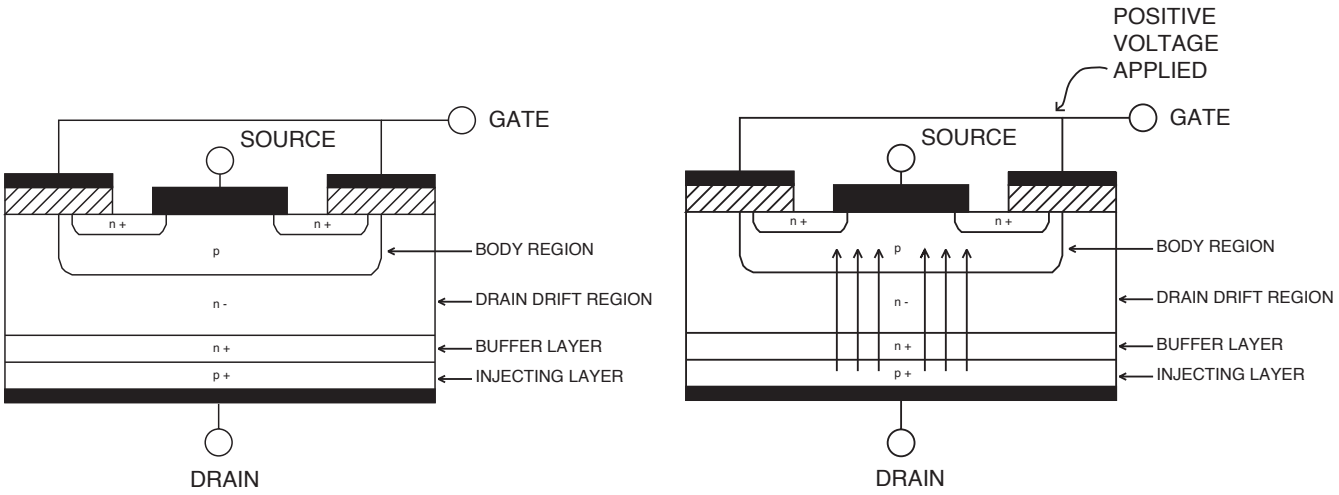
1. Capacitor conditioning is required. (This may be required if the machine has been off for a long period of time and is connected for high input voltage operation.) This is typically related to capacitor imbalance.

2. Voltage across a capacitor exceeds 467 volts. (This could result from high line surges or improper input voltage connections.)

3. Voltage across a capacitor is under 170 volts. (This would be due to improper input voltage connections.)

4. Internal component damage.

FIGURE E.8 - IGBT OPERATION



A. PASSIVE **B. ACTIVE**

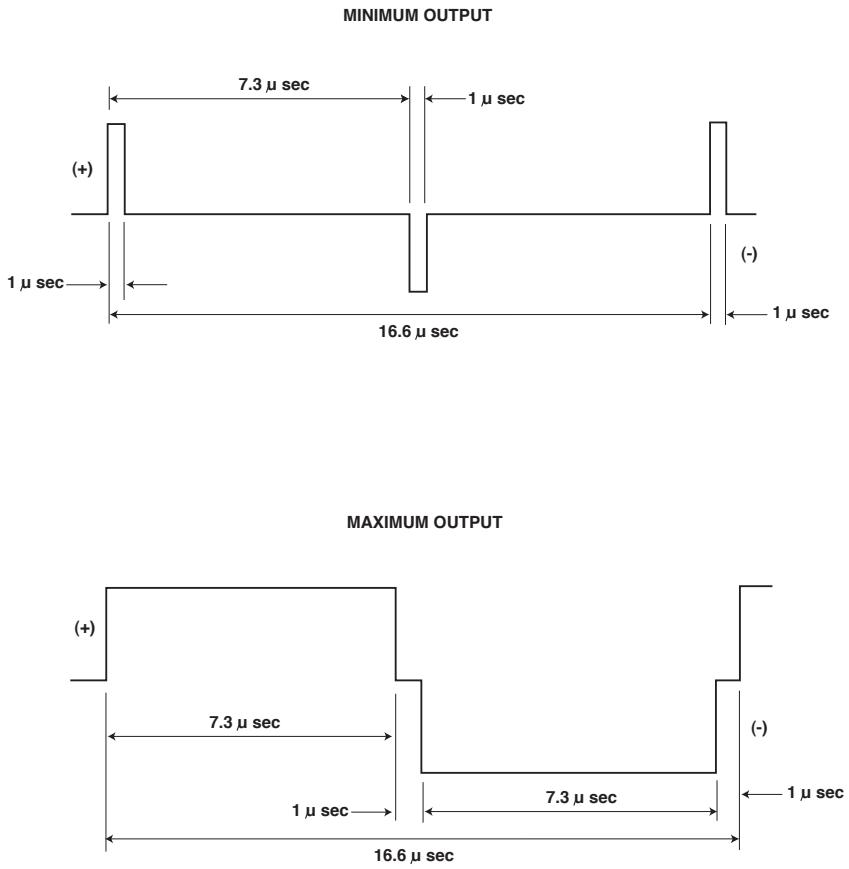
INSULATED GATE BIPOLAR TRANSISTOR (IGBT) OPERATION

An IGBT is a type of transistor. IGBTs are semiconductors well suited for high frequency switching and high current applications.

Drawing A shows an IGBT in a passive mode. There is no gate signal, (zero volts relative to the source), and therefore, no current flow. The drain terminal of the IGBT may be connected to a voltage supply; but since there is no conduction, the circuit will not supply current to components connected to the source. The circuit is turned off like a light switch in the OFF position.

Drawing B shows the IGBT in an active mode. When the gate signal, a positive DC voltage relative to the source, is applied to the gate terminal of the IGBT, it is capable of conducting current. A voltage supply connected to the drain terminal will allow the IGBT to conduct and supply current to circuit components coupled to the source. Current will flow through the conducting IGBT to downstream components as long as the positive gate signal is present. This is similar to turning ON a light switch.

FIGURE E.9 - IGBT OPERATION



PULSE WIDTH MODULATION

The term PULSE WIDTH MODULATION (PWM) is used to describe how much time is devoted to conduction in the positive and negative portions of the cycle. Changing the pulse width is known as MODULATION. Pulse Width Modulation is the varying of the pulse width over the allowed range of a cycle to affect the output of the machine.

MINIMUM OUTPUT

By controlling the duration of the gate signal, the IGBT is turned on and off for different durations during a cycle. The top drawing shows the minimum output signal possible over a 16.6-microsecond time period. The shaded portion of the signal represents one IGBT group (An IGBT group consists of the sets of IGBT modules grouped onto the switch board), conducting for 1 microsecond. The negative portion is the other IGBT group. The dwell time (off time) is 14.6 microseconds (both IGBT groups off). Since only 2 microseconds of the 16.6-microsecond time period are devoted to conducting, the output power is minimized.

MAXIMUM OUTPUT

By holding the gate signals on for 7.3 microseconds each and allowing only 2 microseconds of dwell or off time (one microsecond during each half cycle) during the 16.6 microsecond cycle, the output is maximized.

TABLE OF CONTENTS - TROUBLESHOOTING AND REPAIR

Return to Master TOC
Return to Master TOC
Return to Master TOC
Return to Master TOC

HOW TO USE TROUBLESHOOTING GUIDE

⚠ WARNING

Service and Repair should only be performed by Lincoln Electric Factory Trained Personnel. Unauthorized repairs performed on this equipment may result in danger to the technician and machine operator and will invalidate your factory warranty. For your safety and to avoid Electrical Shock, please observe all safety notes and precautions detailed throughout this manual.

This Troubleshooting Guide is provided to help you locate and repair possible machine malfunctions. Simply follow the three-step procedure listed below.

Step 1. LOCATE PROBLEM (SYMPTOM).
Look under the column labeled "PROBLEM (SYMPTOMS)". This column describes possible symptoms that the machine may exhibit. Find the listing that best describes the symptom that the machine is exhibiting. Symptoms are grouped into the following categories: output problems, function problems, wire feeding problems, and welding problems.

Step 2. PERFORM EXTERNAL TESTS.
The second column labeled "POSSIBLE AREAS OF MISADJUSTMENT(S)" lists the obvious external possibilities that may contribute to the machine symptom. Perform these tests/checks in the order listed. In general, these tests can be conducted without removing the case wrap-around cover.

Step 3. RECOMMENDED COURSE OF ACTION
The last column labeled "Recommended Course of Action" lists the most likely components that may have failed in your machine. It also specifies the appropriate test procedure to verify that the subject component is either good or bad. If there are a number of possible components, check the components in the order listed to eliminate one possibility at a time until you locate the cause of your problem.

All of the referenced test procedures referred to in the Troubleshooting Guide are described in detail at the end of this chapter. Refer to the Troubleshooting and Repair Table of Contents to locate each specific Test Procedure. All of the specified test points, components, terminal strips, etc. can be found on the referenced electrical wiring diagrams and schematics. Refer to the Electrical Diagrams Section Table of Contents to locate the appropriate diagram.

⚠ CAUTION

If for any reason you do not understand the test procedures or are unable to perform the tests/repairs safely, contact the Lincoln Electric Service Department for technical troubleshooting assistance before you proceed. Call 1-888-935-3877.

Return to Section TOC
Return to Master TOC

PC BOARD TROUBLESHOOTING PROCEDURES

⚠ WARNING

ELECTRIC SHOCK can kill.

- Have an electrician install and service this equipment. Turn the input power OFF at the fuse box before working on equipment. Do not touch electrically hot parts.

⚠ CAUTION

Sometimes machine failures appear to be due to PC board failures. These problems can sometimes be traced to poor electrical connections. To avoid problems when troubleshooting and replacing PC boards, please use the following procedure:

1. Determine to the best of your technical ability that the PC board is the most likely component causing the failure symptom.
2. Check for loose connections at the PC board to assure that the PC board is properly connected.
3. If the problem persists, replace the suspect PC board using standard practices to avoid static electrical damage and electrical shock. Read the warning inside the static resistant bag and perform the following procedures:

PC board can be damaged by static electricity.

ATTENTION Static-Sensitive Devices Handle only at Static-Safe Workstations

- Remove your body's static charge before opening the static-shielding bag. Wear an anti-static wrist strap. For safety, use a 1 Meg ohm resistive cord connected to a grounded part of the equipment frame.

- If you don't have a wrist strap, touch an un-painted, grounded, part of the equipment frame. Keep touching the frame to prevent static build-up. Be sure not to touch any electrically live parts at the same time.

- Tools which come in contact with the PC board must be either conductive, anti-static or static-dissipative.

- Remove the PC board from the static-shielding bag and place it directly into the equipment. Don't set the PC board on or near paper, plastic or cloth which could have a static charge. If the PC board can't be installed immediately, put it back in the static-shielding bag.

- If the PC board uses protective shorting jumpers, don't remove them until installation is complete.

- If you return a PC board to The Lincoln Electric Company for credit, it must be in the static-shielding bag. This will prevent further damage and allow proper failure analysis.

4. Test the machine to determine if the failure symptom has been corrected by the replacement PC board.

NOTE: It is desirable to have a spare (known good) PC board available for PC board troubleshooting.

NOTE: Allow the machine to heat up so that all electrical components can reach their operating temperature.

5. Remove the replacement PC board and substitute it with the original PC board to recreate the original problem.
   a. If the original problem does not reappear by substituting the original board, then the PC board was not the problem. Continue to look for bad connections in the control wiring harness, junction blocks, and terminal strips.
   b. If the original problem is recreated by the substitution of the original board, then the PC board was the problem. Reinstall the replacement PC board and test the machine.
6. Always indicate that this procedure was followed when warranty reports are to be submitted.

NOTE: Following this procedure and writing on the warranty report, "INSTALLED AND SWITCHED PC BOARDS TO VERIFY PROBLEM," will help avoid denial of legitimate PC board warranty claims.

Return to Section TOC
Return to Master TOC

Observe Safety Guidelines detailed in the beginning of this manual.

PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
BASIC MACHINE PROBLEMS		
Major physical or electrical damage is evident when the i400 case is removed.	Contact your local authorized Lincoln Electric Service Facility.	Contact the Lincoln Electric Service Department at 1-888-935-3877.
The input fuses repeatedly fail or the input circuit breakers keep tripping.	Make certain the fuses or breakers are properly sized. Make certain the reconnect panel is configured correctly for the applied voltage.	Check the reconnect switches and associated wiring. See the Wiring Diagram. Perform the ***Input Rectifier Test.*** Perform the ***Input PC Board Test.*** Perform the ***Switch Board Test.***
The machine will not power up. No lights. The machine appears to be off.	Make sure the proper input three phase voltage is being applied to the machine (check fuses or breakers). Make sure the input supply disconnect has been turned ON. Make certain the input power switch (SW1) is in the ON position. Check the 10 amp fuse F1 in the reconnect panel area. Make certain the reconnect panel is configured correctly for the applied input voltage. Check circuit breaker CB1 located on the control panel. Reset if tripped.	Check the input switch SW1 for proper operation. Also check the associated leads for loose or faulty connections. See the Wiring Diagram. Perform the ***Auxiliary Transformer Test.*** Perform the ***DC Rectifier Test***. Perform the ***DC Bus Board Test***. Perform the ***Control Board Test***.

⚠ CAUTION

If for any reason you do not understand the test procedures or are unable to perform the tests/repairs safely, contact the Lincoln Electric Service Department for technical troubleshooting assistance before you proceed. Call 1-888-935-3877.

Return to Section TOC
Return to Master TOC

Observe Safety Guidelines detailed in the beginning of this manual.

PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
BASIC MACHINE PROBLEMS		
The PowerWave i400 does not have welding output. The main input contactor (CR1) does not activate.	If the symptom is accompanied by an error code see the ***Status LED Troubleshooting section.*** There may be an external "short" in the external output circuitry. Remove all loads from the output terminals and restart the machine. Make certain the reconnect panel is configured correctly for the applied input voltage. If the thermal LED is lit the unit may be overheated. Adjust the welding load and /or duty cycle to coincide with the output limits of the PW i400. Also see the symptom ***The Thermal LED is ON*** in this section.	Perform the ***Input Board Test.*** Perform the ***Input Rectifier Test.*** Perform the ***Switch Board Test.*** Perform the ***Output Rectifier Test.*** Perform the ***Main Transformer Resistance Test.*** Perform the ***Control Board Test.***
The fan turns on for no apparent reason. The machine still has output.	The thermostat on the Auxiliary Transformer may have opened.	This is normal with long periods of "idle" time. **NOTE:** The Thermal Light does not come on when this occurs and the output is NOT disabled

⚠ CAUTION

If for any reason you do not understand the test procedures or are unable to perform the tests/repairs safely, contact the Lincoln Electric Service Department for technical troubleshooting assistance before you proceed. Call 1-888-935-3877.

Return to Section TOC
Return to Master TOC

Observe Safety Guidelines detailed in the beginning of this manual.

PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
BASIC MACHINE PROBLEMS		
The Thermal LED is ON. The machine regularly overheats. There is no welding output.	The welding application may be exceeding the recommended duty cycle and/or current limits of the machine. Dirt and dust may have clogged the cooling channels inside the machine. Refer to the ***Maintenance Section*** of this manual. The air intake and exhaust louvers may be blocked due to inadequate clearance around the machine. Make sure the fan is functioning correctly. This machine is equipped with F.A.N. (fan as needed) circuitry. The fan should run whenever the output is enabled and should continue running for a period of approximately 5 minutes after the output is disabled. The fan should also run if a thermostat has tripped.	Check the thermostats and associated wiring for loose or faulty connections. See the Wiring Diagram.
The Auxiliary 115VAC receptacle is “dead”. No voltage available.	The circuit breaker (CB2) may have tripped. Reset if necessary. Check the Fuse (F1) in the reconnect area. Replace if faulty.	Perform the ***Auxiliary Transformer Test***. Check the 115VAC receptacle and associated wiring for loose or faulty connections. See the Wiring Diagram.

⚠ CAUTION

If for any reason you do not understand the test procedures or are unable to perform the tests/repairs safely, contact the Lincoln Electric Service Department for technical troubleshooting assistance before you proceed. Call 1-888-935-3877.

Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC

Observe Safety Guidelines detailed in the beginning of this manual.

PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
BASIC MACHINE/DEVICE NET. PLC CONTROLLED SYSTEM PROBLEMS		
The “Real Time Clock” no longer functions.	The Control Board Battery may be faulty.	Replace the battery if necessary (Type BS2032). The Control Board may be faulty.
The I 400 will not produce full output.	The input voltage may be too low, limiting the output capabilities of the machine. Make sure all three phase of input power are being applied to the machine. Weld procedure may be set too high. There may be high impedance (poor connections) in the Weld Circuit	Make certain the input voltage is correct for the machine and the reconnect panel configuration. Check the Weld Cables. Perform the ***Output Rectifier Test.*** Perform the ***Current Transducer Test***. Perform the Current and Voltage Calibration Procedure in Power Wave Manager. The Control Board may be faulty. Perform the ***Control Board Test.***
The machine is “triggered” for output but there is no welding output.	Make certain that the welding cables are connected properly.	From the DeviceNet tab of the Diagnostics Utility select Monitor. The Monitor window will be displayed. Verify under the “Produced Assembly” that “Trigger” is highlighted. From the DeviceNet tab of the Diagnostics Utility select Monitor. The Monitor window will be displayed. Verify under the “Produced Assembly” that “Touch Sense is NOT highlighted. The DeviceNet tab of the Diagnostics Utility displays the Power Wave’s passive mode status. If the status needs to be changed, select Configure and make the necessary modifications.

⚠ CAUTION

If for any reason you do not understand the test procedures or are unable to perform the tests/repairs safely, contact the Lincoln Electric Service Department for technical troubleshooting assistance before you proceed. Call 1-888-935-3877.

Return to Section TOC
Return to Master TOC

Observe Safety Guidelines detailed in the beginning of this manual.

PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
DEVICE NET. PLC CONTROLLED SYSTEM PROBLEMS		
(Continued)		From the DeviceNet tab of the Diagnostics Utility select Monitor. The Monitor window will be displayed. Verify under the "Produced Assembly" that "Disable Output is NOT highlighted. Verify that no other modules are faulted. All of the system Status Lights should be steady green. Use the Diagnostics Utility to display any current faults in the system.
The Gas purge is not functioning. No gas flow.	Make sure there is gas available at the input of the gas solenoid. Make certain that the gas line is not obstructed.	The gas solenoid may be faulty. Check to see if the correct DC voltage is being applied to the gas solenoid. See Wiring Diagram. From the DeviceNet tab of the Diagnostics Utility select Monitor. The Monitor window will be displayed. Verify under the "Produced Assembly" that "Gas Purge" is highlighted. The DeviceNet tab of the Diagnostics Utility displays the Power Wave's passive mode status. If the status needs to be changed select Configure and make the necessary modifications. The Wire Drive Board (Feed Head Board) may be faulty. Perform the ***Wire Drive Board Test***. Also check the associated wiring between the Wire Drive Board and the Robotic Interface Receptacle for loose or faulty connections.

⚠ CAUTION

If for any reason you do not understand the test procedures or are unable to perform the tests/repairs safely, contact the Lincoln Electric Service Department for technical troubleshooting assistance before you proceed. Call 1-888-935-3877.

Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC

Observe Safety Guidelines detailed in the beginning of this manual.

PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
DEVICE NET. PLC CONTROLLED SYSTEM PROBLEMS		
Device fails to go on line.	Make sure the 24VDC supply is on. Check the Baud rate. Check the wiring Verify that the DeviceNet MAC ID is correct. Make sure the correct EDS (Electronic Data Sheet Files) are being used if they are needed.	Check that LED 10 on the Devicenet Board is ON The baud rate setting should be the same as the DeviceNet Master. Verify the integrity of all multi-port taps and field attachable ends. **NOTE:** The DeviceNet tab of the Diagnostics Utility is used to set the Baud rate and the MAC ID. It also displays the correct Product Code and Vendor Revision of the Power Wave i400.
Device goes off line during welding	There may be noise/interference causing the problem. Shielding Power Supply Expected Packet Rate Termination	Make certain that the DeviceNet cables are not running in close proximity with the weld leads or input cables. Verify that the cable shielding is correctly grounded at the bus power supply. The shield should be tied into the bus ground at only one point. Make certain that the DeviceNet bus power supply can supply sufficient current for the devices on the network. Verify that the Expected Packet Rate is less than or equal to 1000 scans per second. **NOTE:** The DeviceNet tab on the Diagnostics Utility displays these values Make sure the DeviceNet bus is terminated correctly.

⚠ CAUTION

If for any reason you do not understand the test procedures or are unable to perform the tests/repairs safely, contact the Lincoln Electric Service Department for technical troubleshooting assistance before you proceed. Call 1-888-935-3877.

Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC

Observe Safety Guidelines detailed in the beginning of this manual.

PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
DEVICE NET. PLC CONTROLLED SYSTEM PROBLEMS		
The output will not come on **NOTE:** For steps 1 thru 3, use the DeviceNet tab of the Diagnostic Utility and select 'Monitor'. For Step 4, select 'Configure.	1. DeviceNet trigger not asserted 2. Touch Sense Command 3. Output Disabled 4. Passive Mode	1. Under "Product Assembly, verify that "Trigger" is highlighted. 2. Under "Product Assembly", verify that "Touch Sense" is NOT activated. 3. Under "Product Assembly", verify that "Disable Output" is NOT activated. 4. Select "Configure" and make the necessary adjustments. Check weld cables for proper connection. Verify that no other modules are faulted (all status lights are steady green).
The welding starting is poor.	Check Drive Roll Tension, wire feed conduit and contact tip. Check the "Strike Wire Speed" setting Verify that the correct Weld Schedule has been selected Make sure the Voltage Sense Leads are connected securely and the polarity is correct. Make sure that all analog input values are within limits. Make sure the shielding gas flow is correct and that gas is flowing before the output is turned on.	Using the DeviceNet tab of the Diagnostic Utility, Verify that: • "Analog Scans Between Updates" is 1/4 of "I/OScans/sec" value. • Select "Configure" and verify in "Analog Input Channels" that Hysteresis settings are all '0'. • Select "Monitor" then "Analog Input Fan Out" and verify that 'Burnback' is present for all analogs.

⚠ CAUTION

If for any reason you do not understand the test procedures or are unable to perform the tests/repairs safely, contact the Lincoln Electric Service Department for technical troubleshooting assistance before you proceed. Call 1-888-935-3877.

Return to Section TOC
Return to Master TOC

Observe Safety Guidelines detailed in the beginning of this manual.

PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
DEVICE NET. PLC CONTROLLED SYSTEM PROBLEMS/WELD & ARC PROBLEMS		
The Analog inputs don't respond or don't respond quickly.	Use the DeviceNet tab of the Diagnostic Utility to check for problems.	Select "Configure" then "Analog Input Channels" and: • Verify that the required channels are set active. • Verify that all Hysteresis settings are '0'. • Check the 'Passive Mode" and make any necessary corrections. Verify that "Analog Scans Between Updates" is 1/4 of "I/O Scans/sec" value.
General degradation of the welding performance.	Check for proper wire feeding. Make certain that the actual speed is the same as the preset. Verify that the correct wire drive and gear ratio have been selected. Check the welding cables for loose or faulty connections. Check for adequate gas shielding. Make sure the welding process is correct for the wire feed and voltage settings.	Perform the Current and Voltage Calibration Procedure in Power Wave Manager.
The wire burns back to the tip with the arc is initiated.	Make sure the voltage sense leads are secure and not damaged Make sure the voltage sense leads and in the correct polarity for the process being used. Make sure the wire feeding is smooth and correct.	The Control Board may be faulty. Perform the ***Control Board Test.***

⚠ CAUTION

If for any reason you do not understand the test procedures or are unable to perform the tests/repairs safely, contact the Lincoln Electric Service Department for technical troubleshooting assistance before you proceed. Call 1-888-935-3877.

Return to Section TOC
Return to Master TOC

Observe Safety Guidelines detailed in the beginning of this manual.

PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
DEVICE NET. PLC CONTROLLED SYSTEM PROBLEMS/ETHERNET PROBLEMS		
The end of the weld is not acceptable.	Make sure all of the settings for Burnback and Crater states are set correctly for the welding process being used. Verify that the Burnback has a value other than 0. Verify the burnback set points for workpoint, trim, and wave values. Make sure the shielding gas flow is adequate.	Using the DeviceNet tab on the Diagnostics Utility select Monitor. Verify under the “State Enabled” that the Burnback is present. Make sure the Analog Scans Between Updates is ¼ of the “I/O Scans/Sec” value. Verify under “Analog Input Fan Out” that the Burnback is present for all analogs in. From the DeviceNet tab of the Diagnostics Utility select Configure. Verify in “Analog Input Channels” that the Hysteresis settings are all 0.
The system will not connect.	Make sure that the correct patch cable or cross over cable is being used. Verify that the cables are fully inserted into the bulk head connector. For direct connection to the Fanuc R30iA Controller use only the cable provided with the K2677-1 integration kit. Verify that the network device connected to the Power Wave is either a 10-baseT device or a 10/100-baseT device. LED 8 located under the PC board Ethernet connector will be lit when the machine is connected to another network device.	Use Weld Manager (included on the Power Wave Utilities and Service Navigator CD’s or available at www.powerwavesoftware.com) to verify the correct IP address information has been entered. The IP address configuration MUST be set to dynamic when connected to the Fanuc R30iA Controller. Verify that no duplicate IP addresses exist on the network.

⚠ CAUTION

If for any reason you do not understand the test procedures or are unable to perform the tests/repairs safely, contact the Lincoln Electric Service Department for technical troubleshooting assistance before you proceed. Call 1-888-935-3877.

Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC

Observe Safety Guidelines detailed in the beginning of this manual.

PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
WELD & ARC QUALITY PROBLEMS		
The wire burns back to the tip at the end of the weld.	Reduce the burnback time. Reduce the workpoint.	N/A
During a weld the machine shuts down.	This is usually an Inverter of system fault.	A non-recoverable inverter fault will interrupt welding output and deactivate the main contactor. This condition will also result in an alternating red and green status light on the control panel. See The ***Status Light Section.***
The arc is excessively long and erratic.	Make certain the correct wire drive and gear ratio have been selected for the welding process being used. Check the voltage sense leads for loose or faulty connections. Make sure the electrode and work sense leads are not reversed. Make sure the shielding gas is correct for the welding process being used. Also make sure the flow rate is correct.	Perform the Current and Voltage Calibration Procedure in Power Wave Manager.
Arc loss fault on robot.	This may be caused be a wire feeding problem. Verify that the proper wire drive and gear ratio have been selected for the welding process. For larger diameter wire consider the highest torque/lowest range gear ration available to suit the application. Check the conduit leading to the wirefeeder. Check for bends and twists that may impede the wire feeding.	N/A

⚠ CAUTION

If for any reason you do not understand the test procedures or are unable to perform the tests/repairs safely, contact the Lincoln Electric Service Department for technical troubleshooting assistance before you proceed. Call 1-888-935-3877.

Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC

Return to Section TOC
Return to Master TOC

USING THE STATUS LED TO TROUBLESHOOT SYSTEM PROBLEMS

The POWER WAVE® i400 is equipped with two externally mounted status lights, one for the power source, and one for the wire drive module contained in the power source. If a problem occurs it is important to note the condition of the status lights. **Therefore, prior to cycling power to the system, check the power source status light for error sequences as noted below.**

Included in this section is information about the power source and Wire Drive Module Status LED's, and some basic troubleshooting charts for both machine and weld performance.

The STATUS LIGHTS are dual-color LED's that indicate system errors. Normal operation for each is steady green. Error conditions are indicated in the following table.

Light Condition	Meaning
Steady Green	System OK. Power source is operational, and is communicating normally with all healthy peripheral equipment connected to its ArcLink network.
Blinking Green	Occurs during power up or a system reset, and indicates the POWER WAVE® i400 is mapping (identifying) each component in the system. Normal for first 1-10 seconds after power is turned on, or if the system configuration is changed during operation.
Fast Blinking Green	Under normal conditions indicates Auto-mapping has failed. Also used by the Diagnostics Utility (included on the POWER WAVE® Utilities and Service Navigator CD's or available at www.powerwavesoftware.com) to identify the selected machine when connecting to a specific IP address.
Alternating Green and Red	Non-recoverable system fault. If the Status lights are flashing any combination of red and green, errors are present. **Read the error code(s) before the machine is turned off.** Error Code interpretation through the Status light is detailed in the Service Manual. Individual code digits are flashed in red with a long pause between digits. If more than one code is present, the codes will be separated by a green light. Only active error conditions will be accessible through the Status Light. Error codes can also be retrieved with the Diagnostics Utility (included on the POWER WAVE® Utilities and Service Navigator CD's or available at www.powerwavesoftware.com). This is the preferred method, since it can access historical information contained in the error log. To clear the active error(s), turn power source off, and back on to reset.
Steady Red	Not applicable.
Blinking Red	Not applicable.

ERROR CODES FOR THE POWER WAVE®

The following is a partial list of possible error codes for the POWER WAVE® i400. For a complete listing consult the Service Manual for this machine.

POWER SOURCE——WELD CONTROLLER

Error Code # (LE Co.)		FANUC	Indication
31	Primary (Input) overcurrent error.	49	Excessive Primary current present. May be related to a switch board or output rectifier failure.
32	Capacitor “A” under voltage (right side facing the Switch PC Board)	50	Low voltage on the main capacitors. May be caused by improper input configuration, or an open/short circuit in the primary side of the machine.
33	Capacitor bank "B" under voltage (left side facing the Switch PC Board)	51	
34	Capacitor "A" over voltage (right side facing the Switch PC Board)	52	Excess voltage on the main capacitors. May be caused by improper input configuration, excessive line voltage, or improper capacitor balance (see Error 43).
35	Capacitor "B" over voltage (left side facing the Switch PC Board)	53	
36	Thermal error	54	Indicates over temperature. Usually accompanied by Thermal LED. Check fan operation. Be sure process does not exceed duty cycle limit of the machine.
37	Softstart (pre-charge) error	55	Capacitor precharge failed. Usually accompanied by codes 32 and 33.
39	Misc. hardware fault	57	Unknown glitch has occurred on the fault interrupt circuitry. Sometimes caused by primary over current fault, or intermittent connections in the thermostat circuit.
43	Capacitor delta error	67	The maximum voltage difference between the main capacitors has been exceeded. May be accompanied by errors 32-35. May be caused by an open or short in the primary or secondary circuit(s).
54	Secondary (output) Error	84	The long-term secondary (output) current limit has been exceeded. This error will immediately turn off the machine output.
			A complete list of error codes is available in the Diagnostics Utility (included on the POWER WAVE® Utilities and Service Navigator CD’s or available at www.powerwavesoftware.com). Error codes that contain three or four digits are defined as fatal errors. These codes generally indicate internal errors on the Power Source Control Board. If cycling the input power on the machine does not clear the error, contact the Service Department.

Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC

Observe all Safety Guidelines detailed throughout this manual

ERROR CODES FOR THE POWER WAVE® (Continued)

WIRE DRIVE MODULE

Error Code # (LE Co.)	FANUC	Indication
81 Motor Overload	129	Long term average motor current limit has been exceeded. Typically indicates mechanical overload of system. If problem continues consider higher torque gear ratio (lower speed range).
82 Motor Overcurrent	130	Absolute maximum motor current level has been exceeded. This is a short term average to protect drive circuitry.
83 Shutdown #1	131	The Shutdown inputs on the POWER WAVE® i400 have been disabled. The presence of these errors indicates the Feed Head Control PCB may contain the wrong operating software.
84 Shutdown #2	132	

CHASSIS REMOVAL AND CAPACITOR DISCHARGE PROCEDURE

⚠ WARNING

Service and repair should be performed by only Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment may result in danger to the technician or machine operator and will invalidate your factory warranty. For your safety and to avoid electrical shock, please observe all safety notes and precautions detailed throughout this manual.

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-888-935-3877.

DESCRIPTION

This “safety” procedure should be performed before any internal maintenance or repair procedures are attempted on the Power Wave i-400. Capacitance normally discharges within two minutes of removing input power. This procedure is used to check that the capacitors have properly discharged.

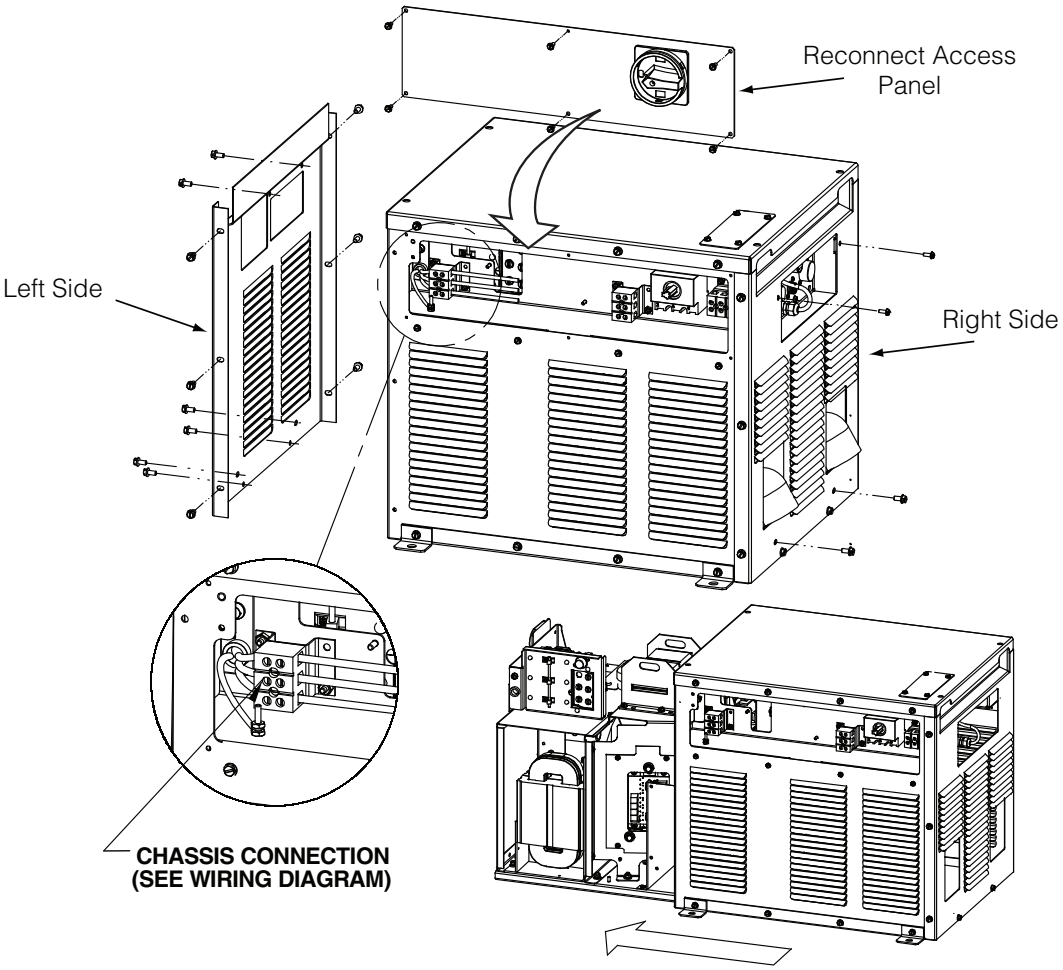
MATERIALS NEEDED

Misc. Hand Tools
DC Voltmeter
25 -1000 Ohm -25 Watt Resistor (minimum)

Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC

CHASSIS REMOVAL AND CAPACITOR DISCHARGE PROCEDURE (continued)

FIGURE - CHASSIS REMOVAL



CHASSIS REMOVAL PROCEDURE:

1. Turn off input power to the power source and any other equipment connected to the welding system at the disconnect switch or fuse box before working on the equipment.

2. Remove the weld cables from the output terminals and disconnect all control cables including the Ethernet connection from the control panel.

3. Remove the screws securing the chassis to the cabinet as listed below. See Figure above.

4. Using the 5/16 inch nut driver remove the six screws securing the reconnect access panel on the front of the machine. The ON/OFF switch must be in the OFF position for removal.

5. Disconnect the chassis input power leads 1E, 2E, and 3E located in the cabinet reconnect area. Label for reassembly. Remove the green ground lead from the cabinet.

6. Using the 3/8 inch nut driver remove the four screws on the right side panel. (2) screws on either side of the control panel and (2) screws just below the output terminals.

7. Using the 3/8 inch nut driver remove the twelve screws located on the left side panel.

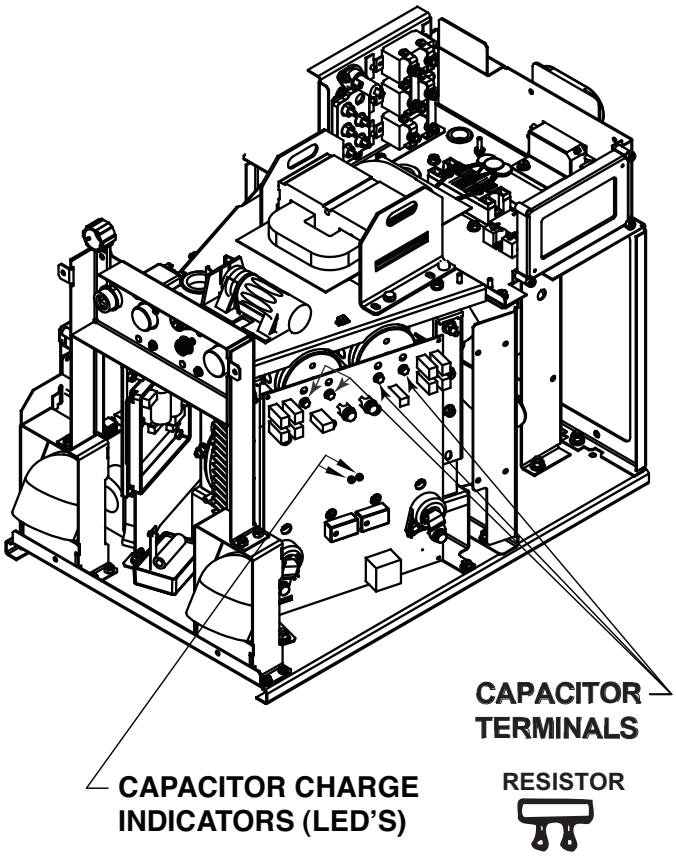
8. Remove left side panel by pulling out from the bottom.

9. Carefully slide the chassis from the cabinet by pulling on the fan bracket.

Return to Section TOC
Return to Master TOC

CHASSIS REMOVAL AND CAPACITOR DISCHARGE PROCEDURE (continued)

FIGURE - CAPACITOR LOCATION



CAPACITOR DISCHARGE PROCEDURE:

1. Be careful not to make contact with capacitor terminals located on the right side of chassis as shown in figure F.27.

2. Carefully check for DC voltage at the capacitor terminals. The presence of capacitor voltage is also indicated by LEDs. See Figure above.

3. If the capacitor voltage is present discharge the capacitors as follows.

4. Using the high wattage resistor (25- 1000 ohms @ 25 watts (minimum) , electrically insulated gloves and pliers hold the resistor terminals across the capacitor terminals for 10 seconds.

⚠ WARNING

ELECTRIC SHOCK can kill.

High voltage is present when input power is applied to the machine.

DO NOT TOUCH THE CAPACITOR TERMINALS WITH YOUR BARE HANDS.

NEVER USE A SHORTING STRAP FOR THIS PROCEDURE

5. Repeat procedure for the other capacitor .

6. Recheck the voltage across the capacitor terminals. The voltage should be zero. If any voltage remains, repeat the procedure. NOTE: Any voltage present after discharge has been performed is an abnormal condition and may indicate a switch board problem.

Return to Section TOC
Return to Master TOC

NOTES

Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC

CURRENT TRANSDUCER TEST PROCEDURE

⚠ WARNING

Service and repair should be performed by only Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment may result in danger to the technician or machine operator and will invalidate your factory warranty. For your safety and to avoid electrical shock, please observe all safety notes and precautions detailed throughout this manual.

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-888-935-3877.

TEST DESCRIPTION

This test will help determine if the Current Transducer and associated wiring is functioning correctly.

MATERIALS NEEDED

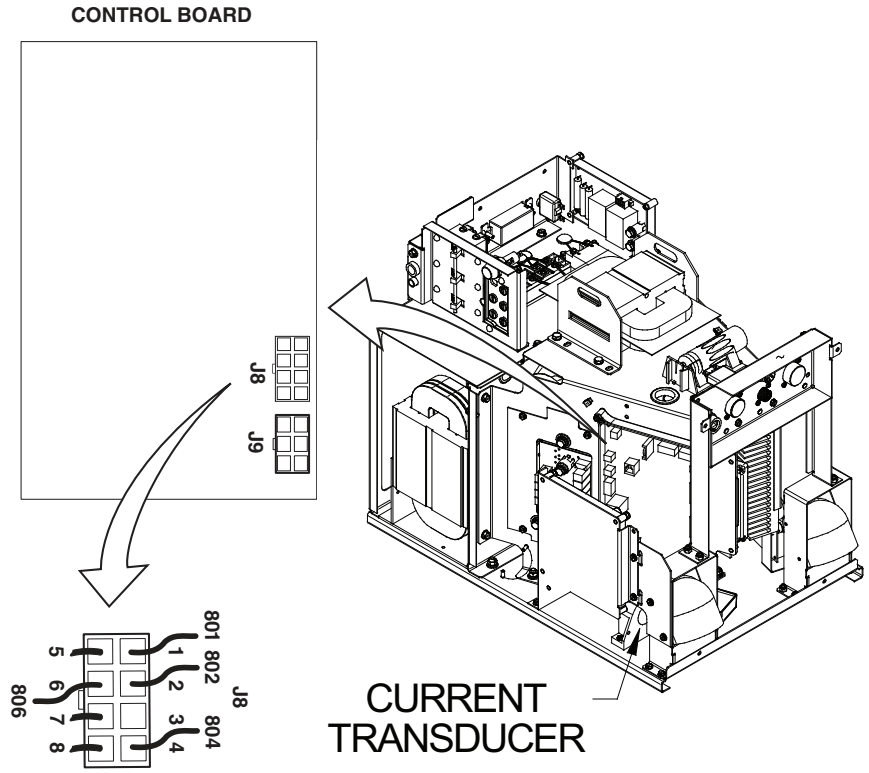
Misc. Hand Tools
Lap-top Computer
Diagnostic Utilities Software
Ethernet Cross Connect Cable (LE Co.# M19969-7)
Resistive Load Bank
(Optional - 50 ft., 4/0 weld cable)
Calibrated Ammeter
Volt-Ohmmeter

NOTE: The Diagnostic Utility Software is on the Utilities Disc that was shipped with the machine. It can also be accessed from the Lincoln Service Navigator or downloaded from the "web" at *Powerwavesoftware.com.*

Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC

CURRENT TRANSDUCER TEST PROCEDURE (continued)

FIGURE F.1 – CURRENT TRANSDUCER TEST



PROCEDURE

1. Disconnect the input power to the POWER WAVE i400.
2. Perform the ***Chassis Removal and Capacitor Discharge Procedure.***
3. Locate the current transducer leads at Control Board plug J8. See Figure F.1.
4. Carefully apply input power to the POWER WAVE i400 at leads E1, E2, E3. See Wiring Diagram.

WARNING

ELECTRIC SHOCK can kill.

High voltage is present when input power is applied to the machine.

5. Turn on the POWER WAVE i400. Check for the correct DC supply voltage to the current transducer at plug J8. See Figure F.1.
   A. Pin 2 (lead 802+) to pin 6 (lead 806-) should read approximately +15 VDC.
   B. Pin 4 (lead 804-) to pin 6 (lead 806+) should read approximately -15 VDC.

NOTE: Do not attempt to check the voltages at the Current Transducer connector. The terminals are small and delicate and may be damaged if probed with meter leads.

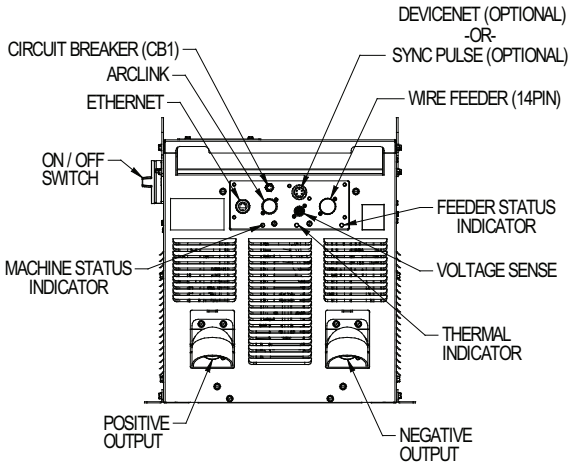
If the DC supply voltages are not present, the Control Board may be faulty. If the supply voltages are correct, proceed to Step 6.

For Steps 6 through 12, refer to information in the Diagnostic Utility found on the Lincoln Service Navigator or at Powerwavesoftware.com.

Return to Section TOC
Return to Master TOC

CURRENT TRANSDUCER TEST PROCEDURE (continued)

FIGURE F.2 – ETHERNET RECEPTACLE



6. Using the Ethernet Cross Connect cable, connect a laptop computer to the PW i400 via the ethernet port on the front of the machine. See Figure F.2.

7. Connect a Load Bank (or 50' weld cable) to the Positive and Negative Output Terminals of the PW i400.

8. Using the "Diagnostic Utility Software":
   Establish Communication with the PW i400
   Select the 'Calibrate' tab.
   Select the '50 amp' Current Set Point
   Select 'Turn Output ON'
   Use an external calibrated ammeter that is not affected by inverter noise to read actual* current

9. Check the transducer feedback voltage at the Control Board plug J8 per Table F.1.
   Pin 1 (lead 801 +) to pin 6 (lead 806 -).

10. Repeat the test at several other current levels.

    If the transducer feedback voltage is correct for the actual current, the Current Transducer is OK

    If there is no feedback voltage, check the wiring from the Control Board to the Current Transducer, See the ***Wiring Diagram.***

CAUTION: If using a weld cable across the output studs instead of a Load Bank, do not exceed the current rating of the cable.

11. If supply voltages are correct but the transducer feedback voltages are incorrect, the Current Transducer or wiring from the Current Transducer to the Control Board may be defective. See the ***Wiring Diagram.***

12. Click on "Turn Output Off"

13. Disconnect the computer.

14. Remove input power and replace chassis.

TABLE F.1 - CURRENT FEEDBACK CHART

OUTPUT CURRENT (Actual)*	TRANSDUCER FEEDBACK VOLTAGE
500	4.0
450	3.6
400	3.2
350	2.8
300	2.4
250	2.0
200	1.6
150	1.2
100	0.8
50	0.4

NOTES

F-24

Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC

SWITCH BOARD TEST PROCEDURE

⚠ WARNING

Service and repair should be performed by only Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment may result in danger to the technician or machine operator and will invalidate your factory warranty. For your safety and to avoid electrical shock, please observe all safety notes and precautions detailed throughout this manual.

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-888-935-3877.

TEST DESCRIPTION

This test will help determine if the “power section” of the switch boards are functioning correctly. This test will NOT indicate if the entire PC board is functional. This resistance test is preferable to a voltage test with the machine energized because this board can be damaged easily. In addition, it is dangerous to work on this board with the machine energized.

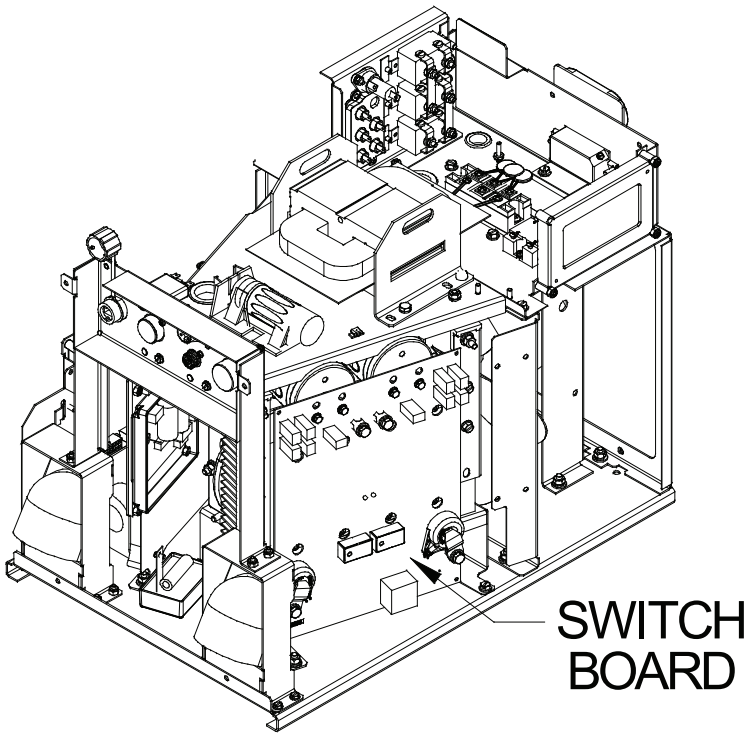
MATERIALS NEEDED

Misc. Hand Tools
Volt-ohmmeter
Wiring Diagram

Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC

SWITCH BOARD TEST PROCEDURE (continued)

FIGURE F.3 – SWITCH BOARD LOCATION



NOTE: Resistance checks of the Switch Board in this machine will vary greatly depending on the type and model of meter being used. Comparative readings between the two sides of a board will be more meaningful than the actual numbers. In all cases, readings of all sets of test points should be approximately the same. If not using an 'auto-ranging' meter, select the X1000 scale.

The readings in ***Table F.2*** are representative of the meters available when this test was developed.

PROCEDURE

1. Disconnect the input power to the POWER WAVE i400.
2. Perform the ***Chassis Removal and Capacitor Discharge Procedure.***
3. Using the volt-ohmmeter, perform the resistance tests detailed in ***Table F.2.*** The readings should all be similar. One or more readings that vary considerably will usually indicate a defective board. Refer to ***Figure F.4*** for the test points.
4. If any test fails replace the Switch Board. See ***Switch Board Removal and Replacement.***
5. If the switch board resistance tests are OK, check the molex pin connections and associated wiring from the switch boards to the control board. See the Wiring Diagram. Make sure +15VDC is being applied to the Switch Board from the Control Board. Plug J20 Pin 2 (+) to Pin 7 (-).

Return to Section TOC
Return to Master TOC

SWITCH BOARD TEST PROCEDURE (continued)

FIGURE F.4 – TEST POINTS

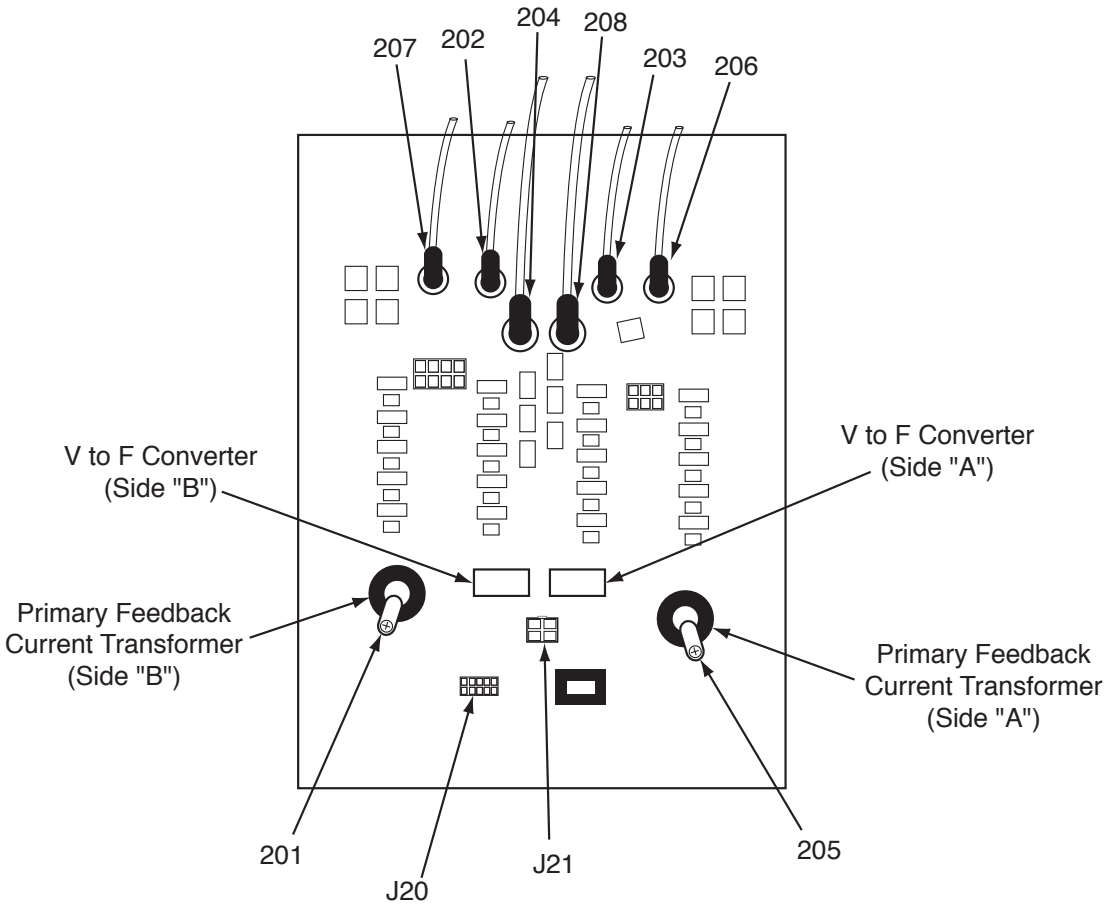


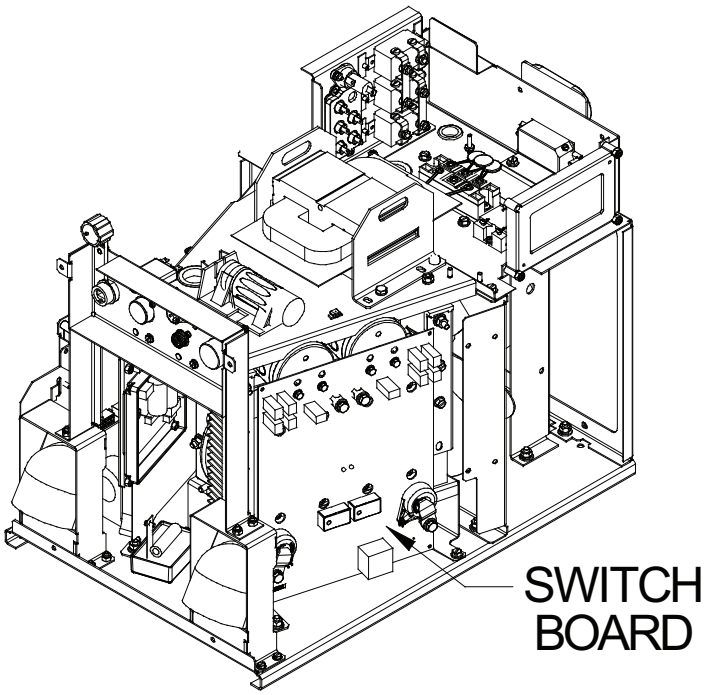
TABLE F.2 – SWITCH BOARD RESISTANCE TEST POINTS

POSITIVE METER PROBE	NEGATIVE METER PROBE	DIGITAL METER (TYPICAL)	ANALOG METER (X1000) TYPICAL
207	201	> 10kΩ	>200Ω
201	207	> 10kΩ	>5kΩ
204	202	> 10kΩ	>200Ω
202	204	> 10kΩ	>5kΩ
205	206	> 10kΩ	>200Ω
206	205	> 10kΩ	>5kΩ
203	208	> 10kΩ	>200Ω
208	203	> 10kΩ	>5kΩ

NOTE: A suspect board should be re-checked after removal from the machine. The actual readings may be different at that time but all similar test points should be comparable. If not, the board is probably defective.

SWITCH BOARD TEST PROCEDURE (continued)

FIGURE F.5 – SWITCH BOARD LOCATION



PRIMARY CURRENT TRANSDUCER(S) TEST

Current Transducers (CT) Test Description

The two primary current transducers (CT1 and CT2) monitor the primary currents in the primary windings of the main transformer. See the Wiring Diagram. The output of the CTs is sent to the control board for processing. If the primary current feedback signals (output of the CTs) are not balanced the control board will adjust the pulse width modulation (PWM) signal sent to the switch board to keep the IGBTs balanced. Also, if either side of the switch board is supplying too much current to the main transformer the control board will remove the PWM signal and the inverter will be shut off to protect the switch board.

The best way to test a current transducer is by measuring the inductance. The CTs are housed on the IGBT switch board. The measurements should always be made without removing the IGBT switch board from the machine.

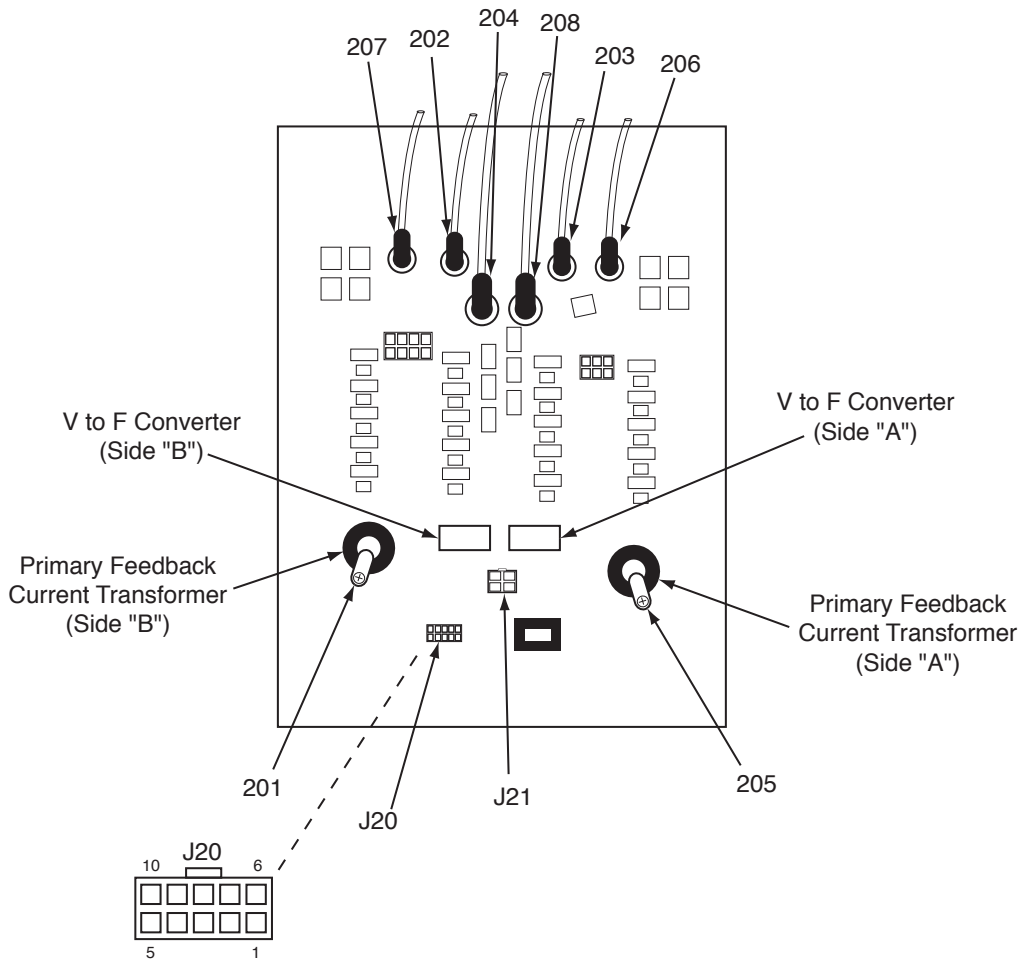
MATERIALS NEEDED

Volt-Ohmmeter with inductance measuring capabilities (Amprobe Model 37XR-A)
Wiring Diagram

Return to Section TOC
Return to Master TOC

SWITCH BOARD TEST PROCEDURE (continued)

FIGURE F.6 – PLUG J20 LEADS AND LOCATION



PROCEDURE

1. Remove the input power to the PW I-400 machine.
2. Using the 5/16 inch nutdriver remove the case wraparound.
3. Perform the ***Chassis Removal and Capacitor Discharge Procedure***.
4. Locate and remove plug J20 from the IGBT Switch Board. See ***Figures F.5*** and F.6.
5. Using the Volt-Ohmmeter with inductance measuring capabilities check the “A” side current transducer inductance by checking from J20 pin 1 (#1002) to J20 pin 6 (#1001). Normal inductance is approximately 50mH. +/- 20%. See Figure F.6. These measurements must be made at the plug J20 receptacle on the PC board.
6. Using the Volt-Ohmmeter with inductance measuring capabilities check the “B” side current transducer inductance by checking from J20 pin 5 (#1020) to J20 pin 10 (#1010). Normal inductance is approximately 50mH. +/- 20%. See Figure F.6. These measurements must be made at the plug J20 receptacle on the PC board.
7. If the inductance reading is not correct replace the IGBT switch board.
8. When testing is complete replace plug J20 into the correct receptacle. See Figure F.6.
9. Re-install the chassis.

Return to Section TOC
Return to Master TOC

NOTES

Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC

OUTPUT RECTIFIER TEST PROCEDURE

⚠ WARNING

Service and repair should be performed by only Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment may result in danger to the technician or machine operator and will invalidate your factory warranty. For your safety and to avoid electrical shock, please observe all safety notes and precautions detailed throughout this manual.

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-888-935-3877.

TEST DESCRIPTION

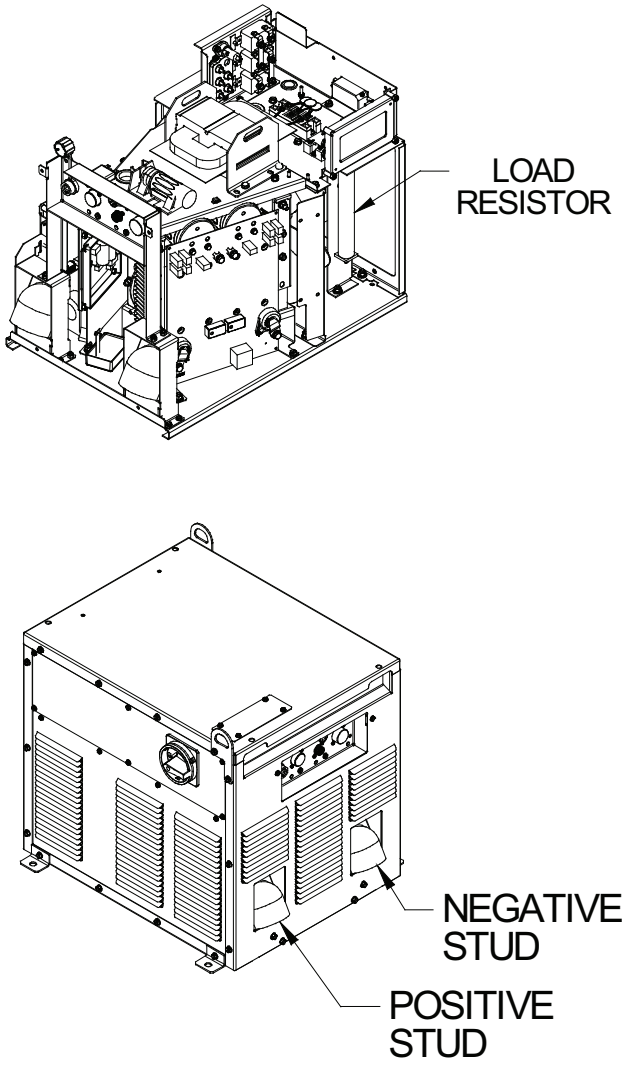
The test will help determine if any of the output rectifiers are shorted.

MATERIALS NEEDED

Misc. Hand Tools
Digital Voltmeter (DVM)

OUTPUT RECTIFIER TEST PROCEDURE (continued)

FIGURE F.7 – LOAD RESISTOR LOCATION



PROCEDURE

1. Remove main input supply power to the POWER WAVE i400.
2. Perform the ***Chassis Removal and Capacitor Discharge Procedure.***
3. Disconnect one lead from the load resistor. See Figure F.7.
4. Using a DVM in the Diode Test mode, check across the output terminals. See Figure F.5. ***See Table F.3.***
5. If the above test fails, disconnect leads X2 from B20 and X4 from B40. ***See Figure F.8. See Figure F.9.***
6. Using a DVM in the Diode Test mode, check the output diodes per ***Table F.4.*** Typical failure mode is a “short”.
7. If the test fails replace the Output Rectifier Board.
8. Reconnect leads X2, X4 and the load resistor.

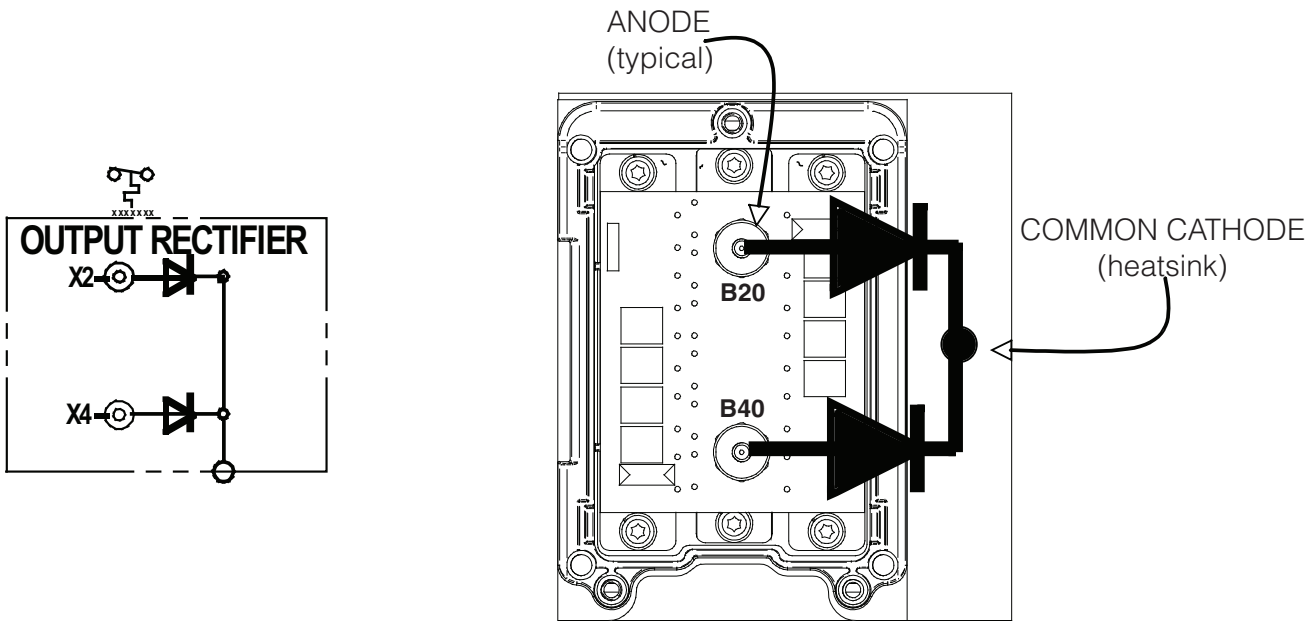
Return to Section TOC
Return to Master TOC

OUTPUT RECTIFIER TEST PROCEDURE (continued)

TABLE F.3

POSITIVE (RED LEAD)	to	NEGATIVE (BLACK LEAD)	DVM MODE	READING
NEGATIVE STUD (ANODE)	to	POSITIVE STUD (CATHODE)	DIODE TEST	.25V to .70V
POSITIVE STUD (CATHODE)	to	NEGATIVE STUD (ANODE)	DIODE TEST	"OPEN"

FIGURE F.8 - B20 & B40 LOCATION



OUTPUT RECTIFIER TEST PROCEDURE (continued)

FIGURE F.9 – OUTPUT RECTIFIER LOCATION

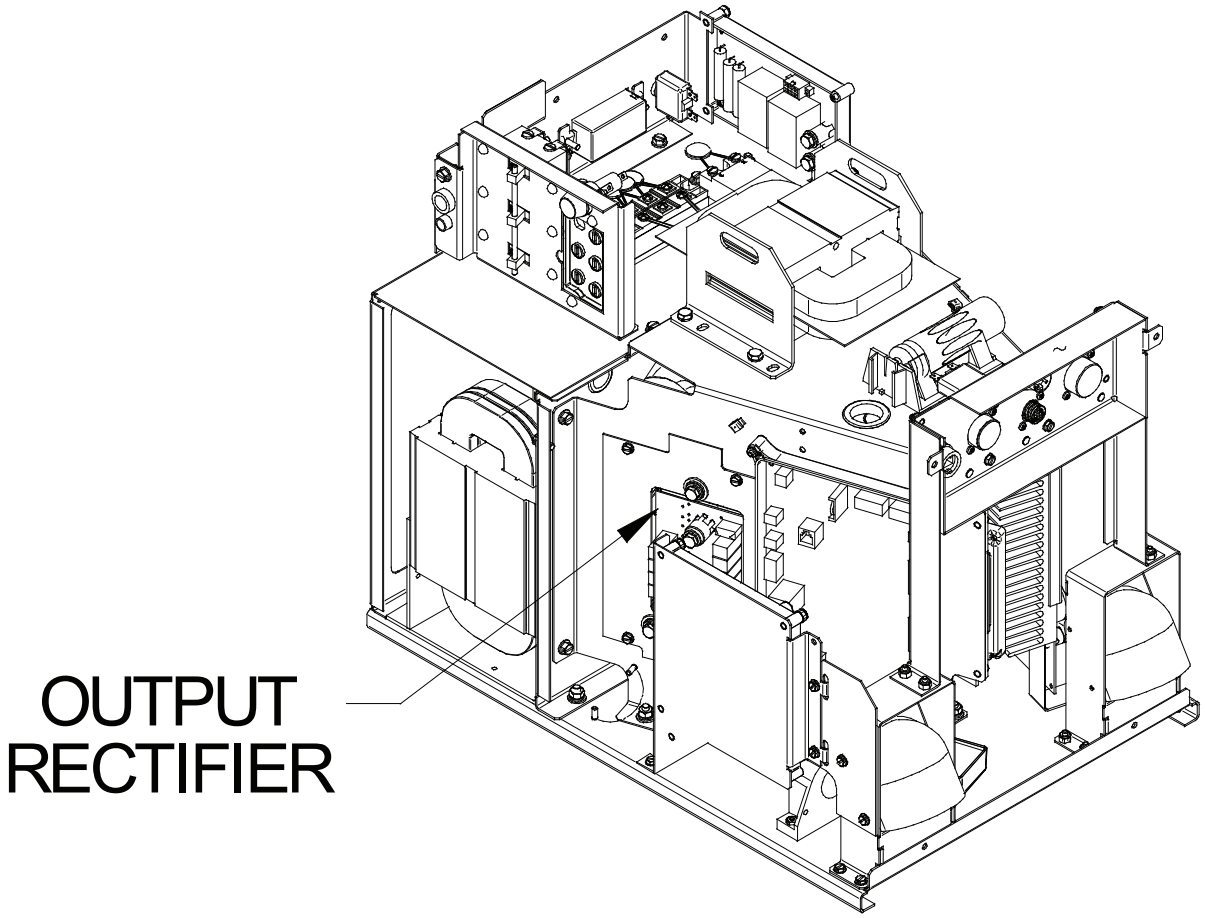


TABLE F.4

POSITIVE (RED LEAD)	to	NEGATIVE (BLACK LEAD)	DVM MODE	READING
B20 (ANODE)	to	HEATSINK (CATHODE)	DIODE TEST	.25V to .70V
HEATSINK (CATHODE)	to	B20 (ANODE)	DIODE TEST	"OPEN"
B40 (ANODE)	to	HEATSINK (CATHODE)	DIODE TEST	.25V to .70V
HEATSINK (CATHODE)	to	B40 (ANODE)	DIODE TEST	"OPEN"

AUXILIARY TRANSFORMER TEST PROCEDURE

⚠ WARNING

Service and repair should be performed by only Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment may result in danger to the technician or machine operator and will invalidate your factory warranty. For your safety and to avoid electrical shock, please observe all safety notes and precautions detailed throughout this manual.

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-888-935-3877.

TEST DESCRIPTION

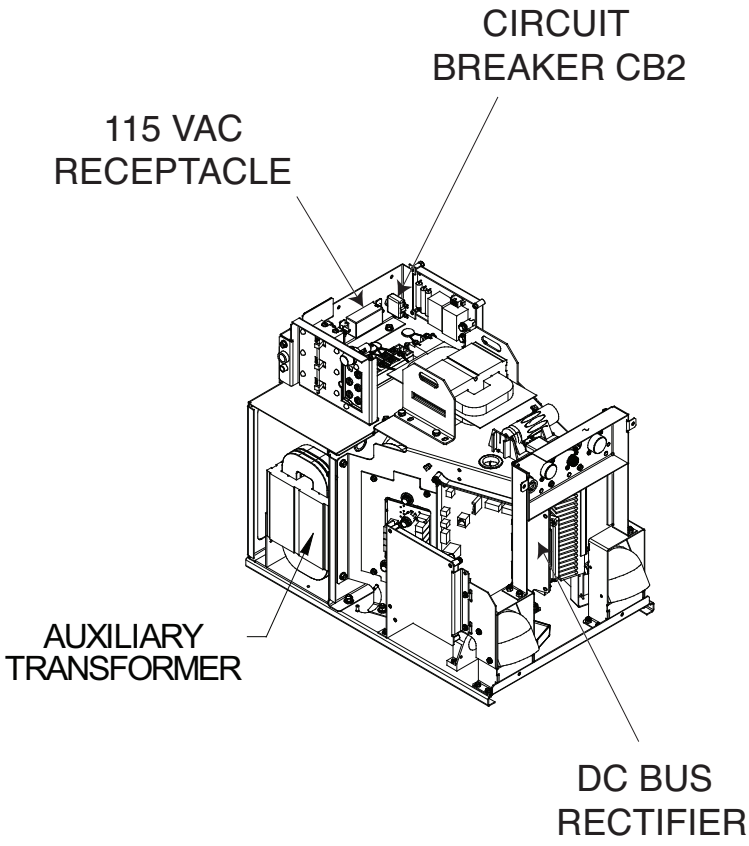
This test will determine if the correct voltage is being applied to the primary of Auxiliary Transformer and also if the correct voltages are being induced on the secondary windings of the transformer.

MATERIALS NEEDED

Volt-Ohmmeter
Misc. Hand Tools
Wiring Diagram

AUXILIARY TRANSFORMER TEST PROCEDURE (continued)

FIGURE F.10 - AUXILIARY TRANSFORMER LOCATION



PROCEDURE

1. Remove main input supply power to the POWER WAVE i400.
2. Perform the ***Chassis Removal and Capacitor Discharge Procedure.***
3. Locate secondary leads X1 (41) and X2 (42) at the DC Bus Rectifier. See to Figure F.10.
4. Locate secondary leads X3 (31) and X4 (33) at circuit breaker CB2 (33) and the 115VAC receptacle (33). See Figure F.10.
5. Carefully apply the correct three phase input voltage to the i400. Leads 1E, 2E and 3E. See Wiring Diagram.

⚠ WARNING

ELECTRIC SHOCK can kill.

High voltage is present at primary of the Auxiliary Transformer.

6. Check for the correct secondary voltages according to ***Table F.5.***

NOTE: The secondary voltages will vary proportionally if the input line voltage varies from nominal.

7. If the correct secondary voltages are present, the auxiliary transformer is functioning properly. If any of the secondary voltages are missing or low, check to make certain the primary is configured correctly for the input voltage applied. Check Fuse F1 and circuit breakers CB1 and CB2. See the ***Wiring Diagram***.
8. If the correct input voltage is applied to the primary, and the secondary voltage(s) are not correct, the transformer may be faulty or overloaded.
9. Replace any cables ties and insulation removed earlier.

Return to Section TOC
Return to Master TOC

AUXILIARY TRANSFORMER TEST PROCEDURE (continued)

TABLE F.5 – SECONDARY VOLTAGES

LEAD IDENTIFICATION	NORMAL VOLTAGE (NO LOAD)
X1(41) TO X2(42)	52 VAC
X3(31) TO X4(33)	115 VAC

NOTES

Return to Section TOC
Return to Master TOC

INPUT RECTIFIER TEST PROCEDURE

⚠ WARNING

Service and repair should be performed by only Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment may result in danger to the technician or machine operator and will invalidate your factory warranty. For your safety and to avoid electrical shock, please observe all safety notes and precautions detailed throughout this manual.

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-888-935-3877.

TEST DESCRIPTION

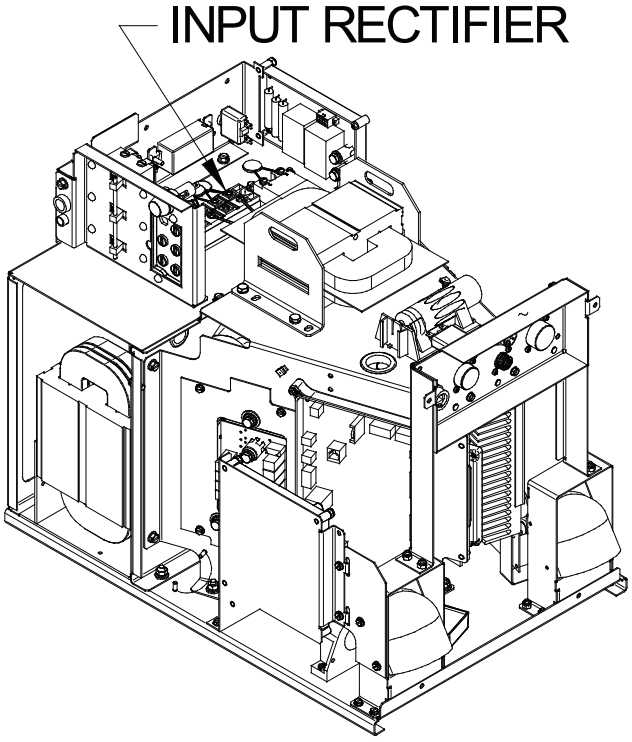
This test will help determine if the input rectifier has “shorted” or “open” diodes.

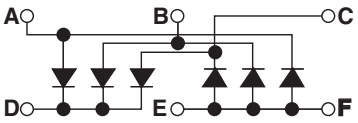
MATERIALS NEEDED

Digital Volt-Ohmmeter (DVM)
Misc. Hand Tools
Wiring Diagram

INPUT RECTIFIER TEST PROCEDURE (continued)

FIGURE F.11 – INPUT RECTIFIER LOCATION





TERMINAL SCHEMATIC

PROCEDURE

1. Remove main input supply power to the POWER WAVE i400.
2. Perform the ***Chassis Removal and Capacitor Discharge Procedure.***
3. Locate the Input Rectifier and lead locations. Refer to Figure F.11.
4. Use a DVM set to the Diode Test Mode to perform the tests detailed in ***Table F.6***.
5. If the rectifier does not meet the expected readings, remove the POS. and NEG leads and re-test. If it still fails the test it should be replaced.

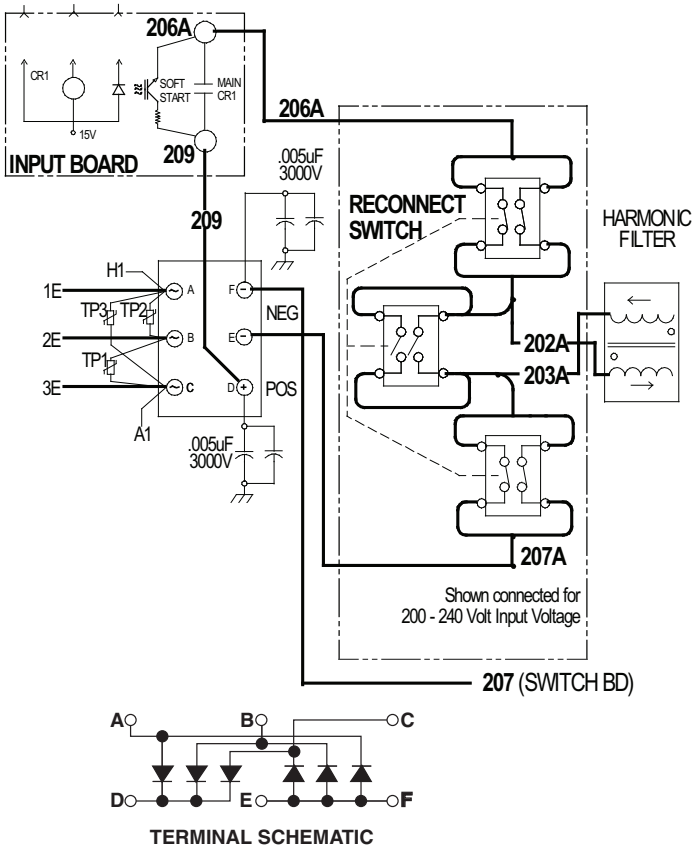
NOTE: Some of the RTV material will have to be removed. The terminals should be re-sealed with RTV when testing or replacement is complete.

6. See the ***Input Rectifier Removal and Replacement*** procedure for proper torque settings when re-connecting the leads to the rectifier.
7. Before installing a new rectifier, perform the ***Switch Board Test***.

INPUT RECTIFIER TEST PROCEDURE (continued)

Table F.6

+ Probe (RED)	- Probe (BLACK)	Result
A (Lead 1E)	D (Lead 209)	0.3V - 0.7V
B (Lead 2E)	D (Lead 209)	0.3V - 0.7V
C (Lead 3E)	D (Lead 209)	0.3V - 0.7V
D (Lead 209)	A (Lead 1E)	OPEN
D (Lead 209)	B (Lead 2E)	OPEN
D (Lead 209)	C (Lead 3E)	OPEN
E (Lead 207A)	F (Lead 207)	SHORT
E (Lead 207A)	A (Lead 1E)	0.3V - 0.7V
E (Lead 207A)	B (Lead 2E)	0.3V - 0.7V
E (Lead 207A)	C (Lead 3E)	0.3V - 0.7V
A (Lead 1E)	E (Lead 207A)	OPEN
B (Lead 2E)	E (Lead 207A)	OPEN
C (Lead 3E)	E (Lead 207A)	OPEN



TERMINAL SCHEMATIC

NOTES

F-42

Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC

DC BUS BOARD TEST PROCEDURE

⚠ WARNING

Service and repair should be performed by only Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment may result in danger to the technician or machine operator and will invalidate your factory warranty. For your safety and to avoid electrical shock, please observe all safety notes and precautions detailed throughout this manual.

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-888-935-3877.

TEST DESCRIPTION

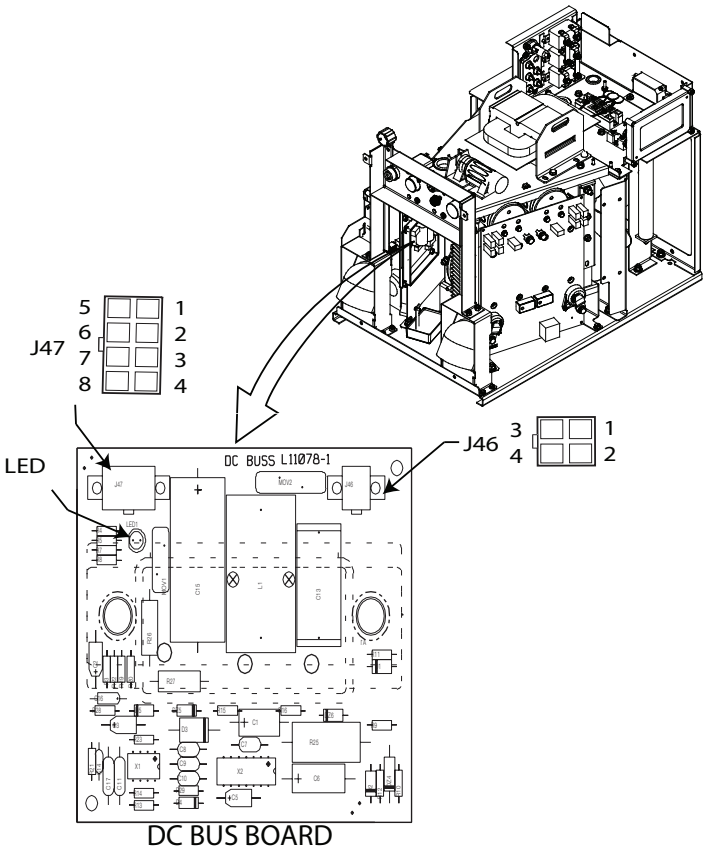
This test will determine if the DC Bus PC Board is receiving and processing the proper voltages.

MATERIALS NEEDED

Misc. Hand Tools
Volt/ohmmeter
Wiring Diagram

DC BUS BOARD TEST PROCEDURE (continued)

FIGURE F.12 – DC BUS PC BOARD



PROCEDURE

1. Remove main input supply power to the POWER WAVE i400.
2. Perform the ***Chassis Removal and Capacitor Discharge Procedure.***
3. Locate the DC Bus PC Board and plugs P46 and P47. See Figure F.12.
4. Carefully apply the correct three phase input power to the POWER WAVE i400 (leads 1E, 2E & 3E). See Wiring Diagram.

WARNING

ELECTRIC SHOCK can kill.

High voltage is present when input power is applied to the machine.

5. Turn on the POWER WAVE i400. The LED on the DC Bus Board should light. See Figure F.12.

If the LED does not light, check the input voltage to the board at Plug J46 Pin 1(+) Lead 65 and Pin 3(-) Lead 66. It should read 65-75vdc.

6. If the input voltage is correct the DC Bus Board may be defective. If the proper input voltage is missing, perform the ***DC Bus Rectifier Test.*** Also perform the ***Auxiliary Transformer Test.***
7. Check the Bus Board output voltages at P47 per Table F.7 below.

TABLE F.7 - DC Bus Bd Output Voltages

Positive Meter Probe	Negative Meter Probe	Voltage Reading (vdc)	Supply For
Pin 3	Pin 6	38 to 42	Control Bd.
Pin 8	Pin 1	38 to 42	Wire Feeder Bd. & Arclink Receptacle

8. If any of the readings are incorrect, replace the DC Bus Board.

Return to Section TOC
Return to Master TOC

CALIBRATION PROCEDURE

⚠ WARNING

Service and repair should be performed by only Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment may result in danger to the technician or machine operator and will invalidate your factory warranty. For your safety and to avoid electrical shock, please observe all safety notes and precautions detailed throughout this manual.

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-888-935-3877.

DESCRIPTION

This procedure will aid the technician in checking and, if necessary, adjusting the calibration of the Power Wave i400.

Calibration should be checked as part of the ***Test After Repair*** and/or if the Control Board is replaced.

MATERIALS NEEDED

Diagnostic Utilities Software (www.powerwavesoftware.com or Service Navigator)
Laptop or other Suitable Computer
Ethernet Cross Connect Cable (LE Co. # M19969-7)
Resistive Load Bank
Two (2) Welding Cables - 20ft. -4/0
Calibrated Ammeter and Voltmeter *

* Calibration inaccuracies due to external metering can and will effect weld performance. Use good quality digital meters that are **calibrated and traceable to National Standards.**

Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC

CALIBRATION PROCEDURE (continued)

CALIBRATION SET-UP:

1. Load the Diagnostic Utility Software into the computer.
2. Use the Ethernet cable to connect the computer to the PWi400.
3. Connect a resistive load bank to the output studs.
4. Energize the PWi400.
5. Launch the Diagnostic Utility and establish communication with the PWi400. (Refer to the Software Documentation to determine proper connection)
6. Click on the “Calibration” tab. A screen similar to Figure F.13 should appear and you are ready to begin the Calibration check

NOTE: The Calibration Screen may look slightly different depending on the software version.

Calibration Tab

⚠ WARNING

Machine output can be turned “on” with this screen.

Feedback Information

- Output Current – Value of Current Sensor Device (transducer).
- Output Voltage – Value of Voltage Sensing point.
- Capacitor Group A and B Voltage values
- Voltage Sense Location – should be sensing at studs for calibration (use “Cable Test” tab to change.)

Current Set Point:

350A machine choose 300A
450A machine choose 300A
650A machine choose 300A
1000A machine choose 500A

Current Weld Mode

- Will always be mode 200 (c.c.) activated from “Turn Output On” button

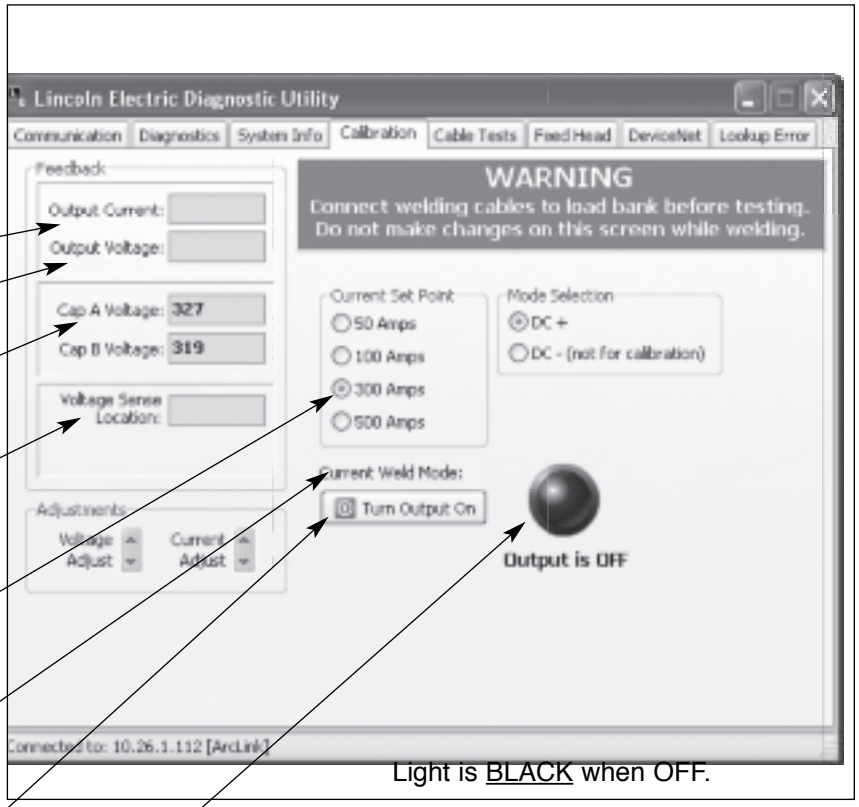
Turn Output ON

- Enables output for calibration
- Light will flash Red when output is “ON”

CALIBRATION ADJUSTMENT

- System will automatically adjust output levels as changes are made

FIGURE F.13 – CALIBRATION SCREEN



Light is BLACK when OFF.

CALIBRATION PROCEDURE (continued)

Calibration can only be done under 'static load' conditions.
Do not attempt to calibrate while welding.

NOTE: Incorrect calibration can and will affect welding performance. It is strongly recommended to use the "Diagnostics" screen to run and save a "Snapshot" before making any calibration adjustments. This will allow returning to original settings if necessary. (Refer to the Software Documentation for instructions on using the Snapshot feature).

CALIBRATION PROCEDURE

1. Once in the "Calibration" screen, make sure that the machine output is OFF (light is BLACK) and connect a resistive load bank to the output studs.

2. Set the load bank for 300 amps.

3. On the Calibration screen, select the "300 Amps" Current Set Point.

NOTE: If the meters on the load bank are not certified, connect calibrated and traceable meters to the machine output. (See ***Materials Needed*** at the beginning of this section).

⚠ WARNING

The Output Studs of the Machine will be Electrically "HOT" during Steps 4 through 7

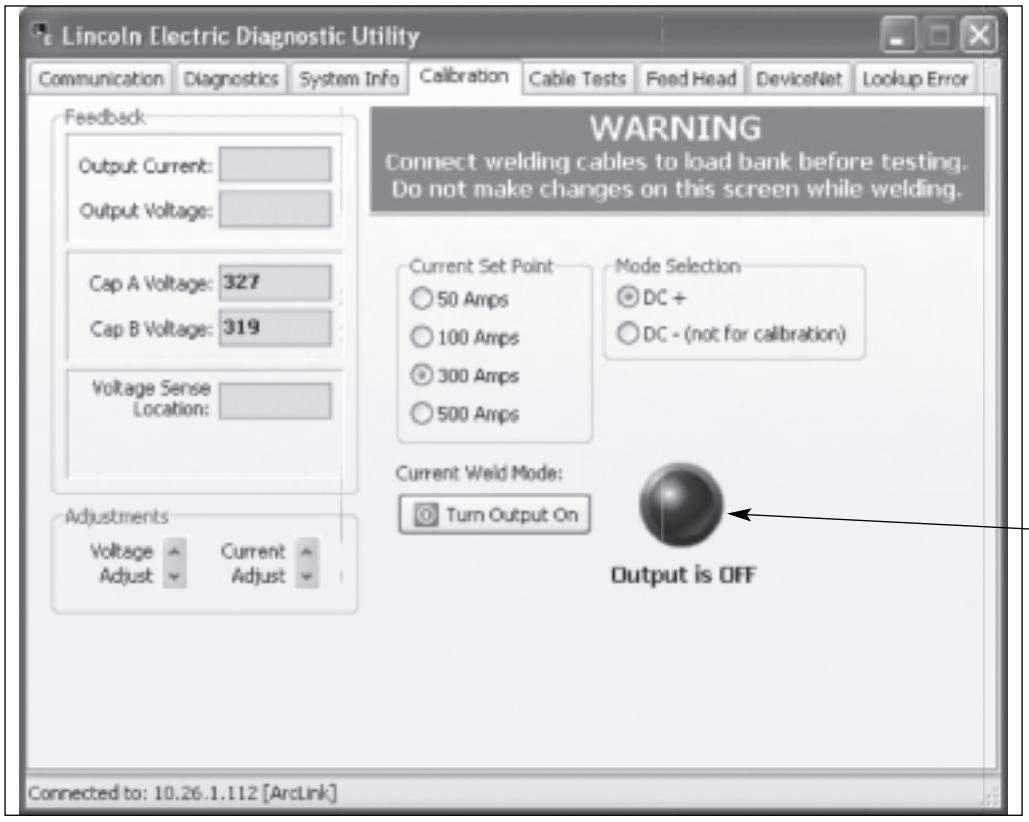
4. Click on the "Turn Output ON" button.
   The BLACK light on the screen will flash RED indicating that the weld output is turned ON. (See Figure F.14).

5. Adjust the load bank to 300 Amps at approximately 32 Volts as read on the external calibrated meters.

6. Using the "Calibration Adjustment" buttons:
   Adjust the current so that the external ammeter reads 300Amps +/-2A.
   Adjust the voltage so that the "Output Voltage" display window reads the same as the external voltmeter +/-.25volts.

7. Click on the "Turn Output Off" button. Calibration is complete.

FIGURE F.14 - CALIBRATION SCREEN



NOTES

F-48

Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC

DC BUS RECTIFIER TEST PROCEDURE

⚠ WARNING

Service and repair should be performed by only Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment may result in danger to the technician or machine operator and will invalidate your factory warranty. For your safety and to avoid electrical shock, please observe all safety notes and precautions detailed throughout this manual.

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-888-935-3877.

TEST DESCRIPTION

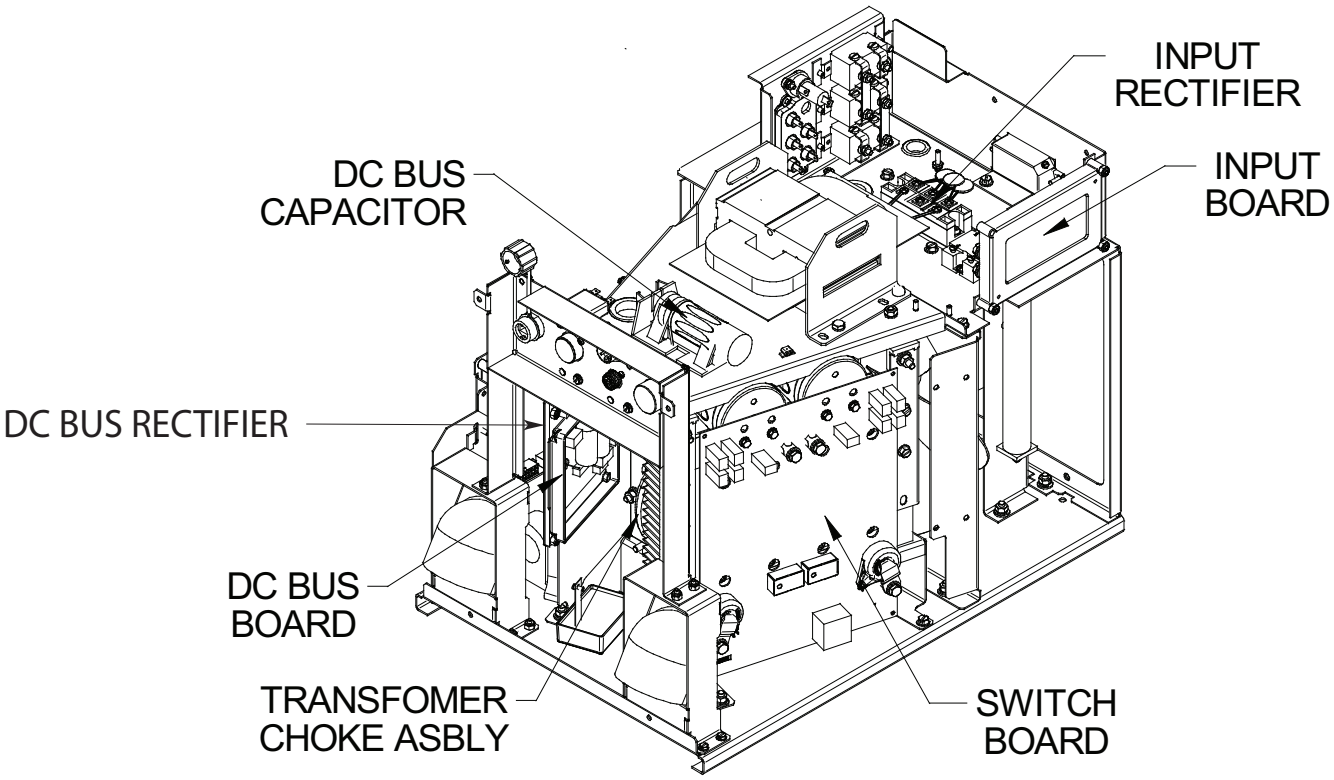
This test will help determine if the DC Bus Rectifier is receiving the correct voltage from the Auxiliary Transformer and if the DC Bus Rectifier and Capacitor are functioning properly.

MATERIALS NEEDED

Volt-Ohmmeter
Wiring Diagram
Misc. Hand Tools

DC BUS RECTIFIER TEST PROCEDURE (continued)

FIGURE F.15 – DC BUS RECTIFIER LOCATION



PROCEDURE

1. Disconnect the input power to the Power Wave i400 machine.
2. Perform the ***Chassis Removal and Capacitor Discharge Procedure.***
3. See Figure F.15 for DC Bus Rectifier location.

⚠ WARNING

ELECTRIC SHOCK can kill.

High voltage is present when input power is applied to the machine.

NOTE: There will be high voltage at terminals B206 and B209 during this test.

4. Carefully apply the correct three-phase input power to leads 1E, 2E, and 3E. These leads were removed from the Input Switch Circuit during the Chassis Removal Procedure.
5. Carefully check for approximately 52VAC at leads 41 to 42. If this voltage is missing check circuit breaker CB1 located on the front panel. See the Wiring Diagram. If circuit breaker CB1 is OK, perform the ***Auxiliary Transformer Test.***

NOTE: Voltages are typical with machine at idle. Low readings may indicate excessive load from another board.

6. If the 52VAC is present at leads 41 to 42, carefully check for approximately 65 - 75VDC at leads 65B (+) to 66B (-). If this voltage is low or missing the DC Bus Rectifier and/or the Bus Capacitor may be faulty. See the Wiring Diagram.

INPUT BOARD TEST PROCEDURE

⚠ WARNING

Service and repair should be performed by only Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment may result in danger to the technician or machine operator and will invalidate your factory warranty. For your safety and to avoid electrical shock, please observe all safety notes and precautions detailed throughout this manual.

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-888-935-3877.

TEST DESCRIPTION

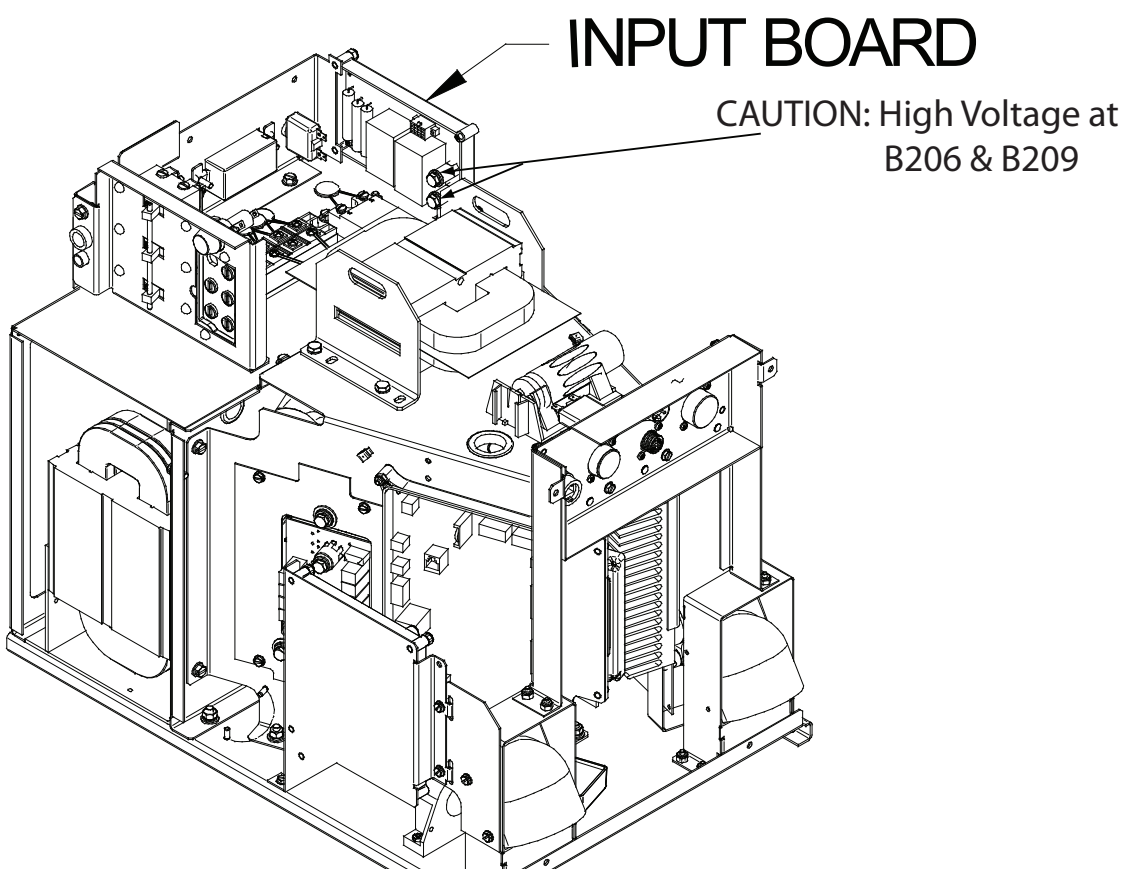
This test will help determine if the Input Board is receiving the correct voltage signals and if the relays and contactors on the Input Board are functioning correctly.

MATERIALS NEEDED

Volt-Ohmmeter
Wiring Diagram
Misc. Hand Tools

INPUT BOARD TEST PROCEDURE (continued)

FIGURE F.16 – INPUT BOARD LOCATION



PROCEDURE

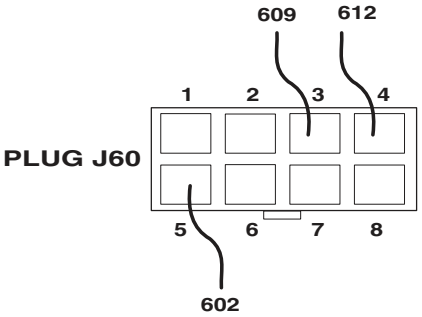
1. Disconnect the input power to the Power Wave i400 machine.
2. Perform the ***Chassis Removal and Capacitor Discharge Procedure.***
3. See Figures F.16, F.17 & ***F.18.*** for Input Board functions and location.
4. Carefully apply the correct three-phase input power to leads 1E, 2E, and 3E. These leads were removed from the Input Switch Circuit during the ***Chassis Removal Procedure.***

WARNING

ELECTRIC SHOCK can kill.

High voltage is present when input power is applied to the machine.

FIGURE F.17 – PLUG J60

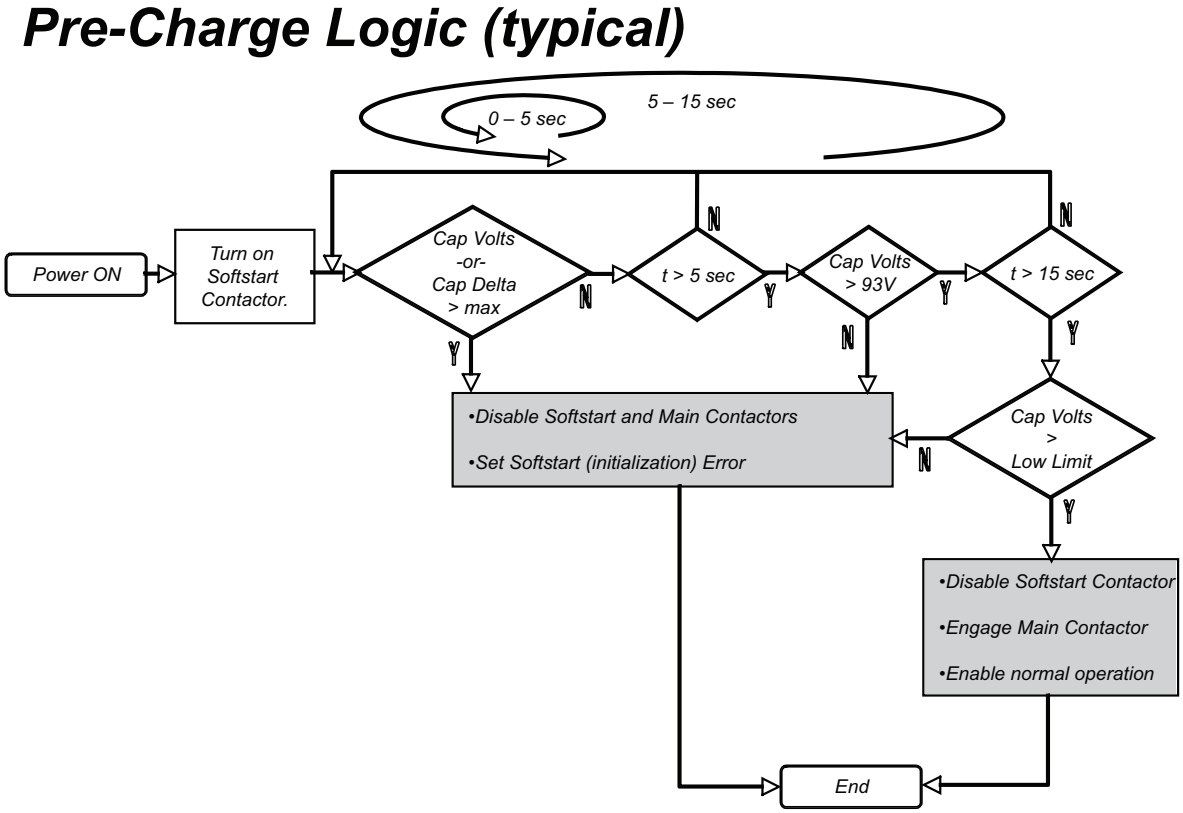


5. For the first 10-15 seconds after the input power is applied 13-15VDC should be present at Plug J60 pins 3(+)(lead 609) to pin 4(-)(lead 612). This is the voltage applied from the Control Board to the energize the Pre-charge relay. See Figure F.17.
6. After approximately 15-20 seconds 13-15VDC should be present at Plug J60. Pins 3(+)(lead 609) to pin 5(-)(lead 602). This is the voltage applied from the Control Board to energize the main contactors that are mounted on the Input Board. The main contactor coil resistance is approximately 40 ohms.

Return to Section TOC
Return to Master TOC

INPUT BOARD TEST PROCEDURE (continued)

FIGURE F.18 – Logic



7. If the correct signal voltages are being applied and the Pre-charge relay and/or the main contactors are not being energized the Input Board may be faulty.
8. If the correct signal voltages are missing check leads 609,602 and 612 for loose for faulty connections between the Input Board and the Control Board. See the Wiring Diagram.
9. Perform the ***Auxiliary Transformer Test.***
10. Perform the ***DC Bus Rectifier Test.***
11. Perform the ***DC Bus Board Test.***
12. The Control Board may be faulty. Perform the ***Control Board Test.***

Return to Section TOC
Return to Master TOC

NOTES

F-54

Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC

MAIN TRANSFORMER RESISTANCE TEST PROCEDURE

⚠ WARNING

Service and repair should be performed by only Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment may result in danger to the technician or machine operator and will invalidate your factory warranty. For your safety and to avoid electrical shock, please observe all safety notes and precautions detailed throughout this manual.

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-888-935-3877.

TEST DESCRIPTION

This test will help determine if the Main Transformer's primary and secondary coils are not "open" or grounded. It will not reveal "turn to turn" shorts.

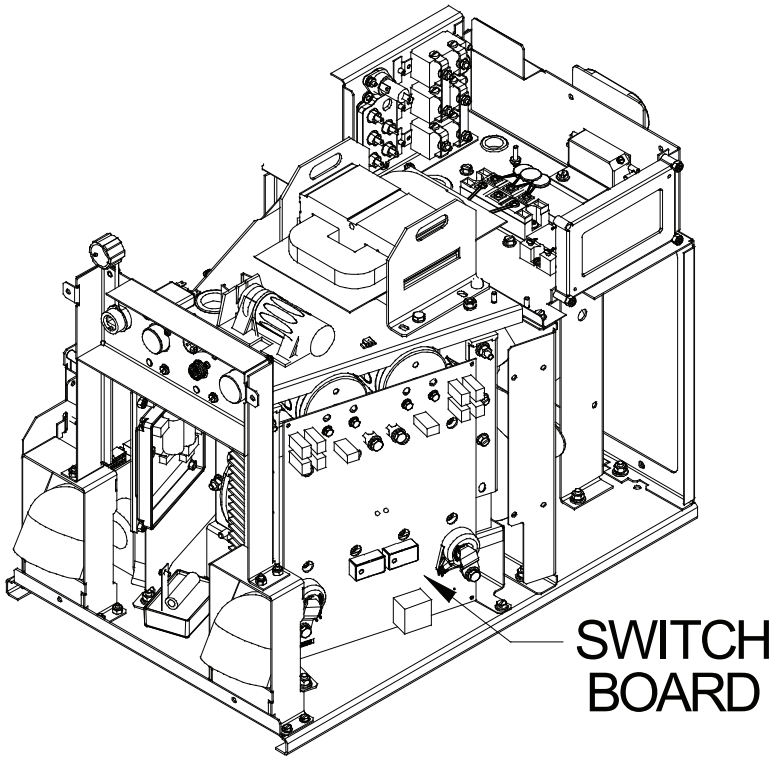
MATERIALS NEEDED

Volt-Ohmmeter
Wiring Diagram
Misc. Hand Tools

Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC

MAIN TRANSFORMER RESISTANCE TEST PROCEDURE (continued)

FIGURE F.19 – SWITCH BOARD LOCATION



PROCEDURE

1. Disconnect the input power to the Power Wave i400 machine.
2. Perform the ***Chassis Removal and Capacitor Discharge Procedure.***
3. See Figures F.19, ***F.20, F.21 & F.22*** within this procedure for testing locations on the Main Switch Board and the Output Rectifier Board. See the Wiring Diagram.
4. Check the Main Transformer Resistances per ***Table F.8.***
5. If the resistance checks are OK the Main Transformer is good.
6. If any of the resistance readings are not within the expected results the Main Transformer may be faulty.

Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC

MAIN TRANSFORMER RESISTANCE TEST PROCEDURE (continued)

FIGURE F.20 – SWITCH BOARD TEST POINTS

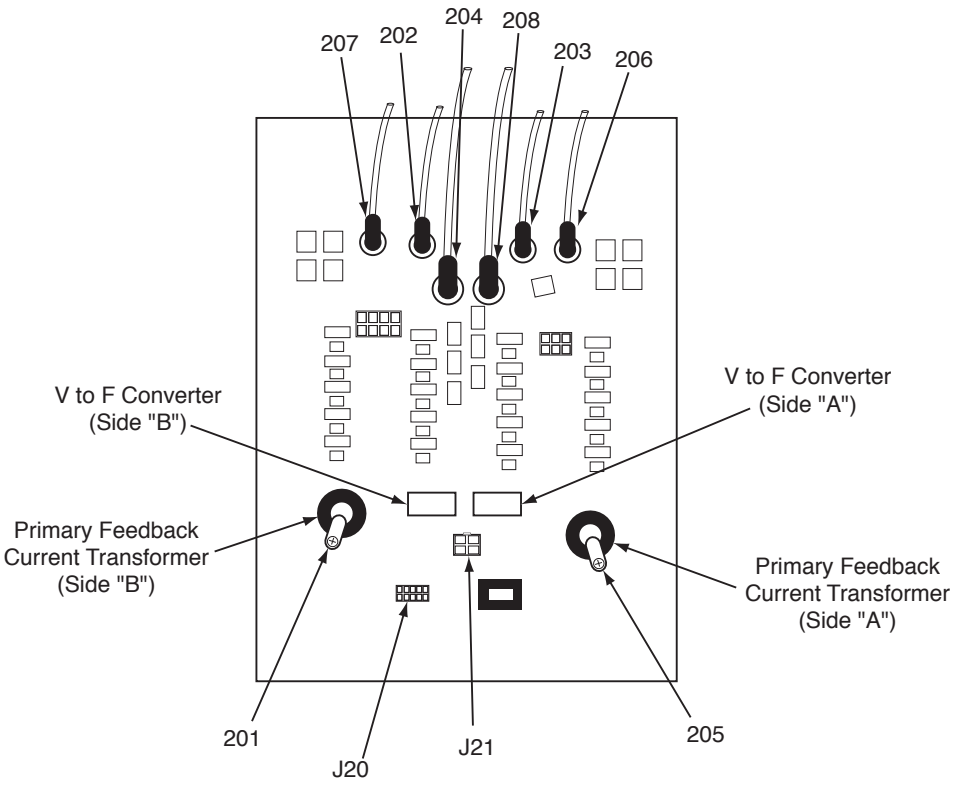
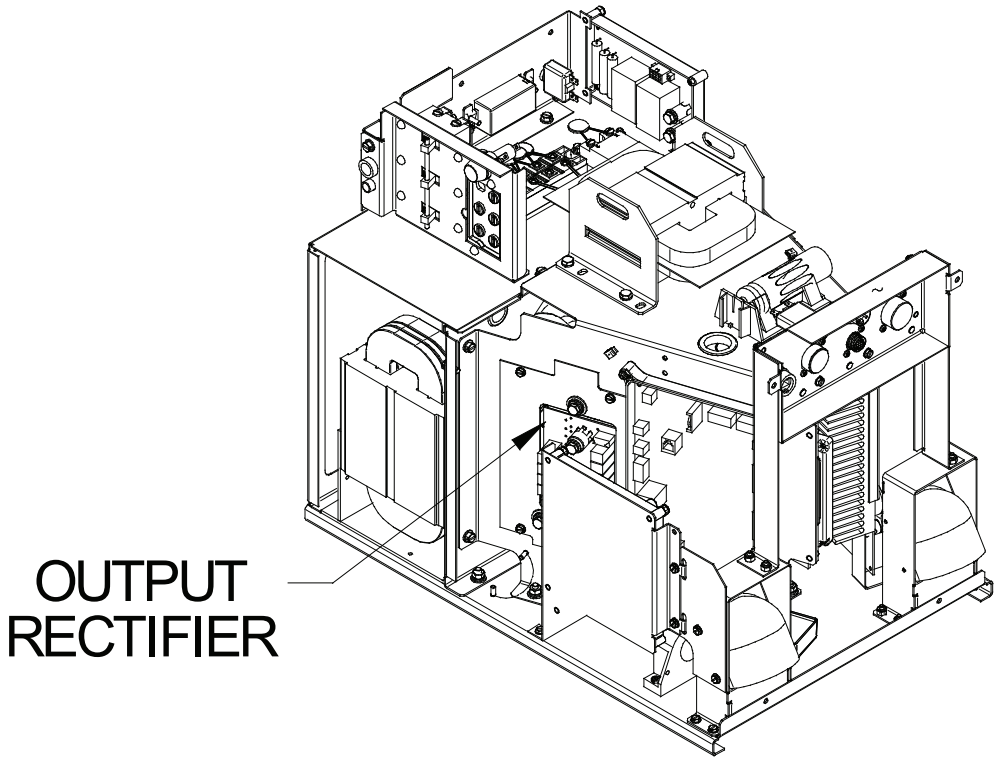


FIGURE F.21 – OUTPUT RECTIFIER



Return to Section TOC
Return to Master TOC

MAIN TRANSFORMER RESISTANCE TEST PROCEDURE (continued)

FIGURE F.22– OUTPUT RECTIFIER TEST POINTS

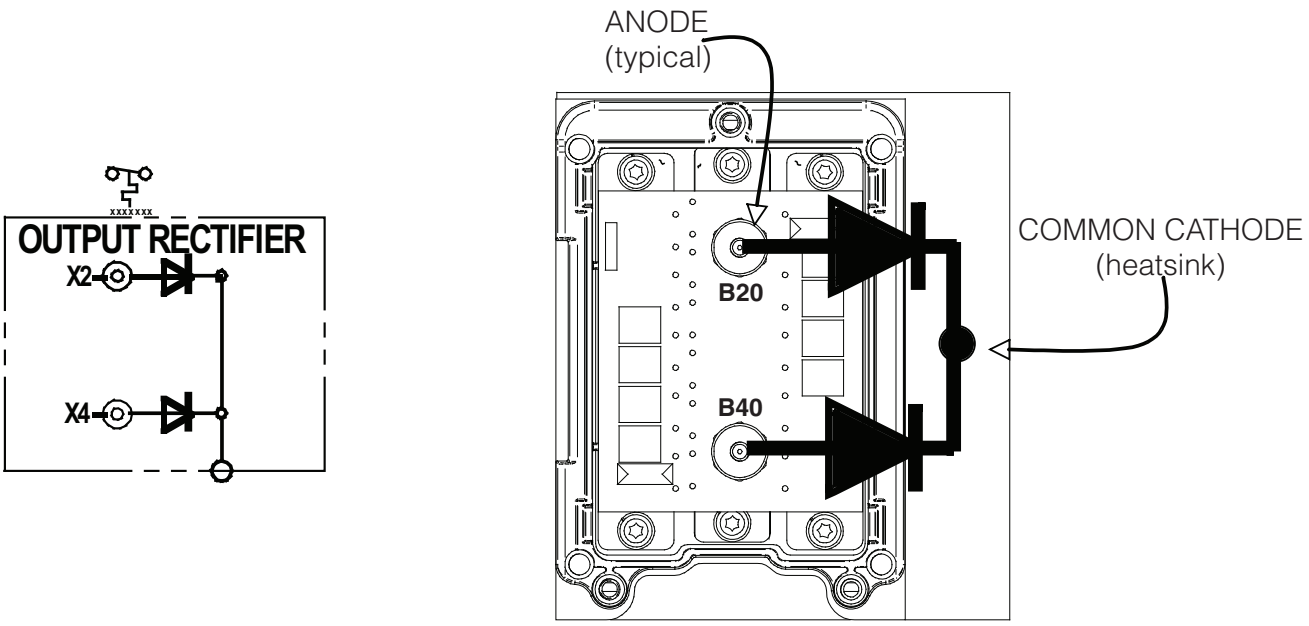


TABLE F.8 – OUTPUT RECTIFIER TEST POINTS

TEST POINT	EXPECTED RESISTANCE READINGS	COMMENTS
205 TO 208 (Switch Board)	ZERO RESISTANCE	PRIMARY COIL
201 TO 204 (Switch Board)	ZERO RESISTANCE	PRIMARY COIL
205 TO Chassis Ground	GREATER THAN 1MEG Ohm	PRIMARY COIL TO GROUND
201 TO Chassis Ground	GREATER THAN 1MEG Ohm	PRIMARY COIL TO GROUND
X2 (B20) TO X4 (B40)	ZERO RESISTANCE	SECONDARY COIL
X2 (B20) TO Chassis Ground	GREATER THAN 1MEG Ohm	SECONDARY COIL TO GROUND
X4 (B40) TO Chassis Ground	GREATER THAN 1MEG Ohm	SECONDARY COIL TO GROUND
201 TO X2(B20)/X4(B40)	GREATER THAN 1MEG Ohm	PRIMARY TO SECONDARY ISOLATION
205 TO X2(B20)/X4(B40)	GREATER THAN 1MEG Ohm	PRIMARY TO SECONDARY ISOLATION

Return to Section TOC
Return to Master TOC

WIRE DRIVE BOARD (FEED HEAD BOARD) TEST PROCEDURE

⚠ WARNING

Service and repair should be performed by only Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment may result in danger to the technician or machine operator and will invalidate your factory warranty. For your safety and to avoid electrical shock, please observe all safety notes and precautions detailed throughout this manual.

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-888-935-3877.

TEST DESCRIPTION

This test will help determine if the Wire Drive Board is receiving the correct voltages and generating the correct output signals.

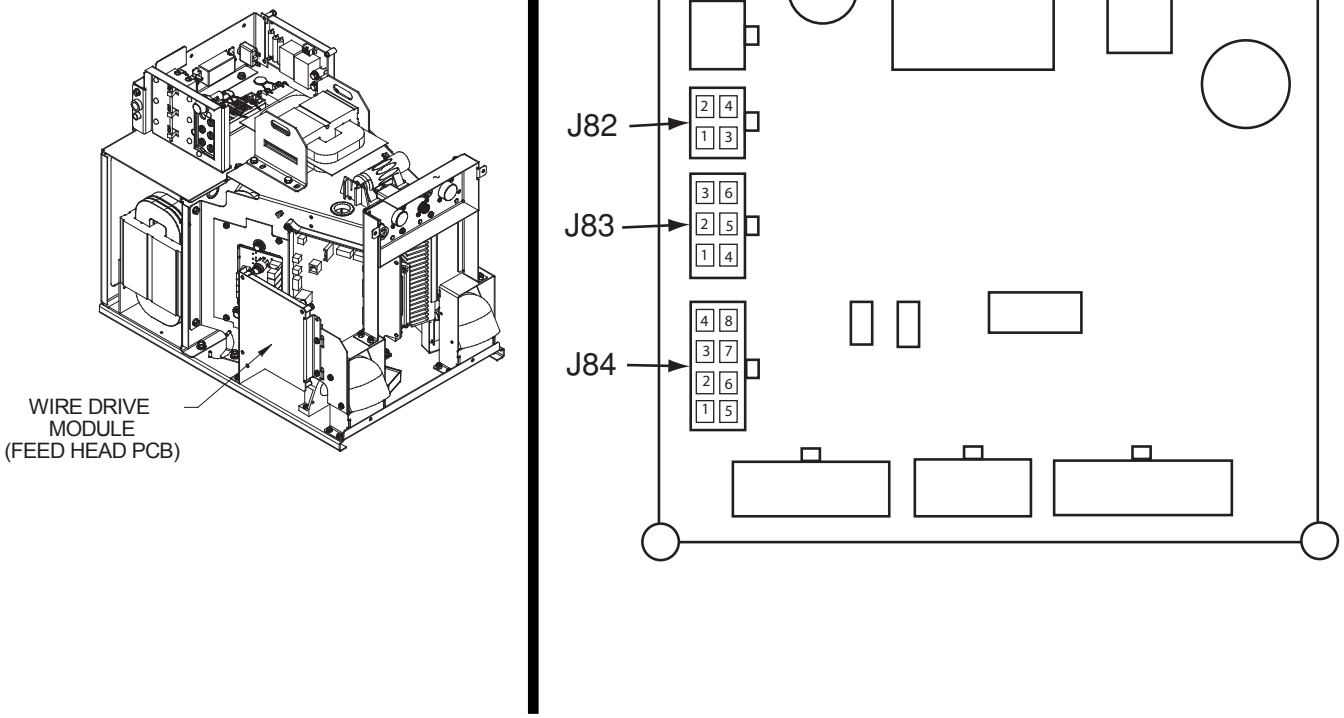
MATERIALS NEEDED

Volt-Ohmmeter
Diagnostic Utilities Software (www.Powerwavesoftware.com or Service Navigator)
Ethernet Cross Connect Cable (LE C)
Laptop or other suitable computer
Wiring Diagram
Misc. Hand Tools

Return to Section TOC
Return to Master TOC

WIRE DRIVE BOARD (FEED HEAD BOARD) TEST PROCEDURE (continued)

FIGURE F.23 – WIRE DRIVE MODULE LOCATION



PROCEDURE

1. Disconnect the input power to the Power Wave i400 machine.
2. Perform the ***Chassis Removal and Capacitor Discharge Procedure.***
3. See Figure F.23 for the Wire Drive Board location.
4. Carefully apply the correct three-phase input power to leads 1E, 2E, and 3E. These leads were removed from the Input Switch Circuit during the ***Chassis Removal Procedure***.
5. Load the Diagnostic Utility Software into the computer.
6. Using the Ethernet cable connect the computer to the i-400.
7. Go to the Feed Head tab on the Diagnostic Utility.
8. The following tests are conducted without a motor or tach connected to the i-400.
9. Carefully check the Wire Drive Board (Feed Head Board) per ***Table F.9.*** See Figure F.21 for molex and pin locations.
10. Also refer to ***Table F.10*** for further information.

Return to Section TOC
Return to Master TOC

WIRE DRIVE BOARD (FEED HEAD BOARD) TEST PROCEDURE (continued)

Table F.9

TEST POINTS	EXPECTED READINGS	CONDITIONS	COMMENTS
Plug J82 pin 4 (+) Lead 52A to Plug J82 pin 3 (-) Lead 51A	40 VDC	Input Power Applied to i400	Power Supplied From DC Bus Board
Plug J83 pin 3 (+) Lead 521 to Plug J81 pin 4 (-) Lead 840	40 VDC	Input Power Applied to i400 Solenoid Not Activated	Power Supplied For Gas Solenoid
Plug J83 pin 3 (+) Lead 521 to Plug J83 pin 4 (-) Lead 522	30 VDC	Input Power Applied to i400 Solenoid Activated From Diagnostic Utility	Reading Recorded With Solenoid Activated
Plug J84 pin 1 (+) White Lead to Plug J84 pin 4 (-) Black Lead	15 VDC	Input Power Applied to i400	Power Supplied For Tach
Plug J84 pin 2 Red Lead to Plug J84 pin 3 Black Lead	0 VDC	Input Power Applied to i400	Tach 1 Differential Voltage
Plug J84 pin 5 Black Lead to Plug J84 pin 6 Green Lead	0 VDC	Input Power Applied to i400	Tach 2 Differential Voltage
Plug 83 pin 1 (+) Lead 539 to Plug J83 pin 2 (-) Lead 541	40 VDC	Input Power Applied to i400 Inch Activated From Diagnostic Utility	Power Supply To Motor

Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC

Removed		No Feeder Connected	Feeder Connected
J82	PWR & ArcLink	No Status LED. Will not operate	No status LED. will not operate
J83	MTR & SOL	No motor or solenoid output	Motor and solenoid not functional
J84	TACH	Max output from motor drive or Error 6311	Max output from motor drive or Error 6311
J85	Status LED	Normal operation, but no status LED	Normal operation, but no status LED

Removed		No Feeder Connected	Feeder Connected
J82-1	ArcLink L	Loss of communication. FH status LED flashes GRN. FH not seen in diagnostic utility.	Loss of communication. FH status LED flashes GRN. FH not seen in diagnostic utility.
J82-2	ArcLink H		
J82-3	COMMON	Loss of power. FH status LED OFF. GRN. FH not seen in diagnostic utility.	Loss of power. FH status LED OFF. GRN. FH not seen in diagnostic utility.
J82-4	40VDC		

Removed		No Feeder Connected	Feeder Connected
J83-1	MTR +	Status LED green. No motor output voltage.	Status LED green. No motor output voltage.
J83-2	MTR -		
J83-3	SOL +	Status LED green. No solenoid output voltage.	Status LED green. Solenoid not opening.
J83-4	SOL -		
J83-5	MTR blocking diode (anode)	Status LED green. No motor output voltage.	Status LED green. No motor output.
J83-6	MTR blocking diode (cathode)		

Removed		No Feeder Connected	Feeder Connected
J84-1	TACH Supply (+15VDC)	Loss of any of these leads will either result in max output from motor drive or Error 6311 (Noisy tach) on the feed head board	Loss of any of these leads will either result in max output from motor drive or Error 6311 (Noisy tach) on the feed head board
J84-2	TACH 1A		
J84-3	TACH 1B		
J84-4	TACH Common (0 VDC)		
J84-5	TACH 2A (unused)	Normal operation	Normal operation
J84-6	TACH 2B (unused)	Normal operation	Normal operation
J84-7	Single TACH Input (unused)	Normal operation	Normal operation

Removed		No Feeder Connected	Feeder Connected
J85-15	Status Light (H=RED)	Normal operation, but no Status LED	Normal operation, but no Status LED
J85-16	Status Light (H=GRN)	Normal operation, but no Status LED	Normal operation, but no Status LED

CONTROL BOARD TEST PROCEDURE

⚠ WARNING

Service and repair should be performed by only Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment may result in danger to the technician or machine operator and will invalidate your factory warranty. For your safety and to avoid electrical shock, please observe all safety notes and precautions detailed throughout this manual.

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-888-935-3877.

TEST DESCRIPTION

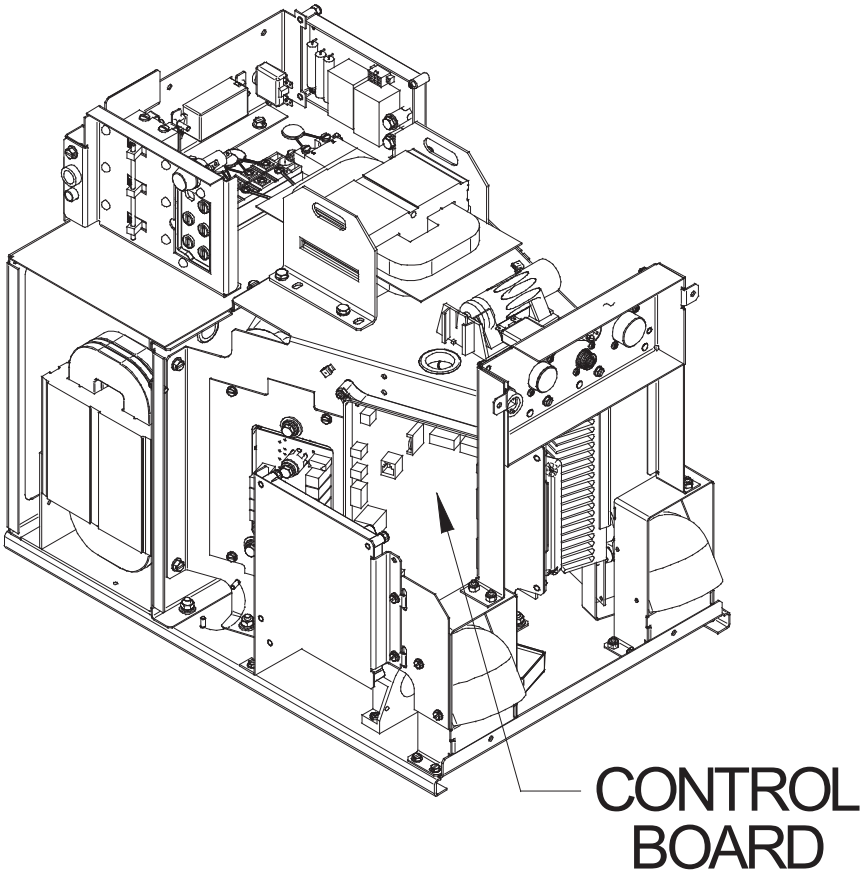
This test will help determine if the Control Board is receiving the correct voltages and signals.

MATERIALS NEEDED

Volt-Ohmmeter
Wiring Diagram
Misc. Hand Tools

CONTROL BOARD TEST PROCEDURE (continued)

FIGURE F.24 – CONTROL BOARD LOCATION



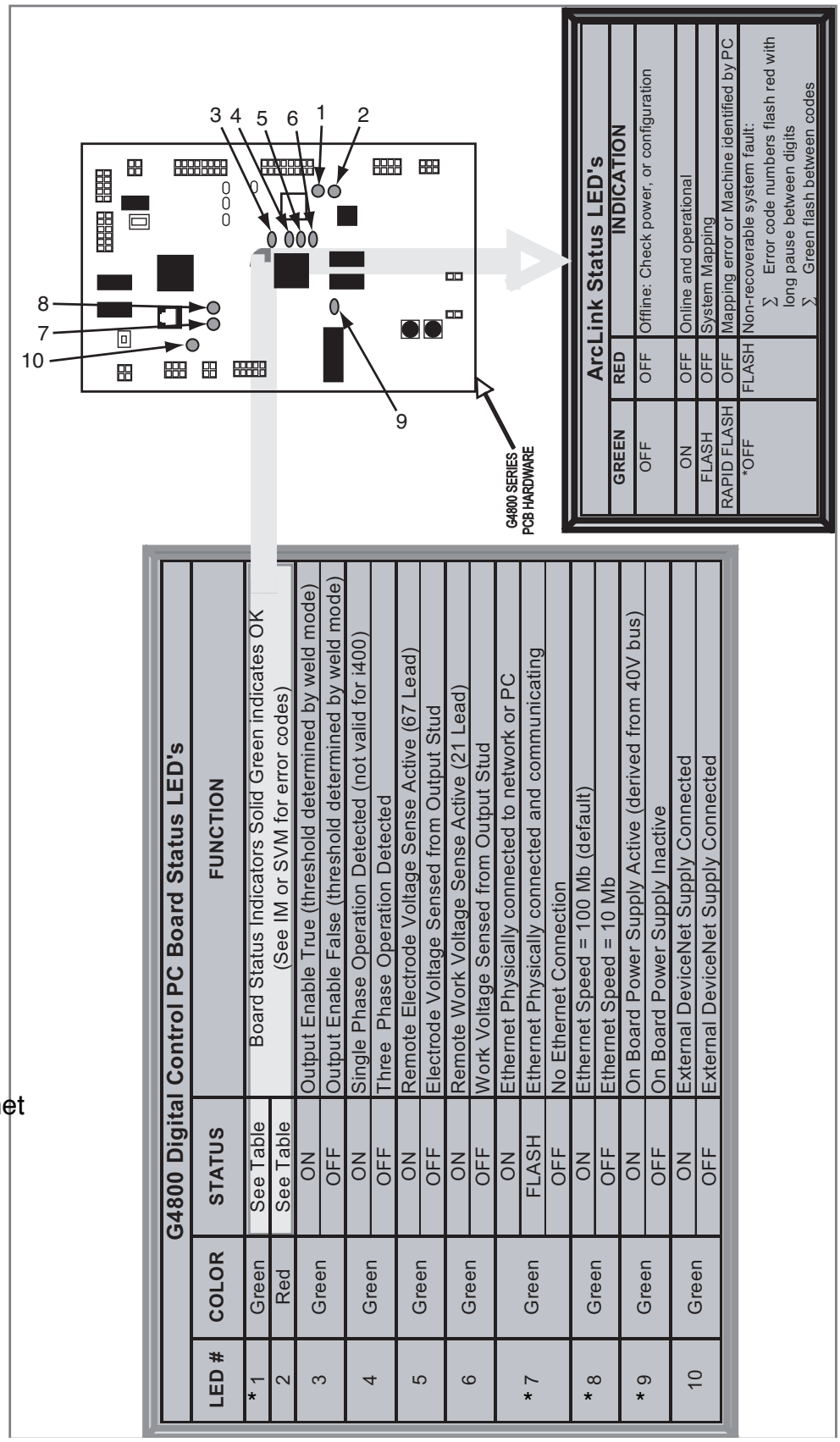
PROCEDURE

1. Disconnect the input power to the Power Wave i400 machine.
2. Perform the ***Chassis Removal and Capacitor Discharge Procedure.***
3. See Figure F.24 for the Control Board location.
4. Carefully apply the correct three-phase input power to leads 1E, 2E, and 3E. These leads were removed from the Input Switch Circuit during the Chassis Removal Procedure.
5. Carefully check the Control Board's LED Status lights for proper operation and/or error signals. See ***Figure F.25.***
6. If further investigation is required carefully check the voltages and resistances per ***Table F.11.*** See ***Figure F.26*** & ***Figure F.27.*** The Wire Drive Board may have to be moved aside for access to the Control Board Molex plugs. See the ***Wire Drive Board Removal Procedure***.
7. Make certain all of the correct voltages and signals are being received by the Control Board before replacing it.

Return to Section TOC
Return to Master TOC

CONTROL BOARD TEST PROCEDURE (continued)

FIGURE F.25 - LED's



ArcLink Status LED's

GREEN	RED	INDICATION
OFF	OFF	Offline: Check power, or configuration
ON	OFF	Online and operational
FLASH	OFF	System Mapping
RAPID FLASH	OFF	Mapping error or Machine identified by PC
*OFF	FLASH	Non-recoverable system fault: Σ Error code numbers flash red with long pause between digits Σ Green flash between codes

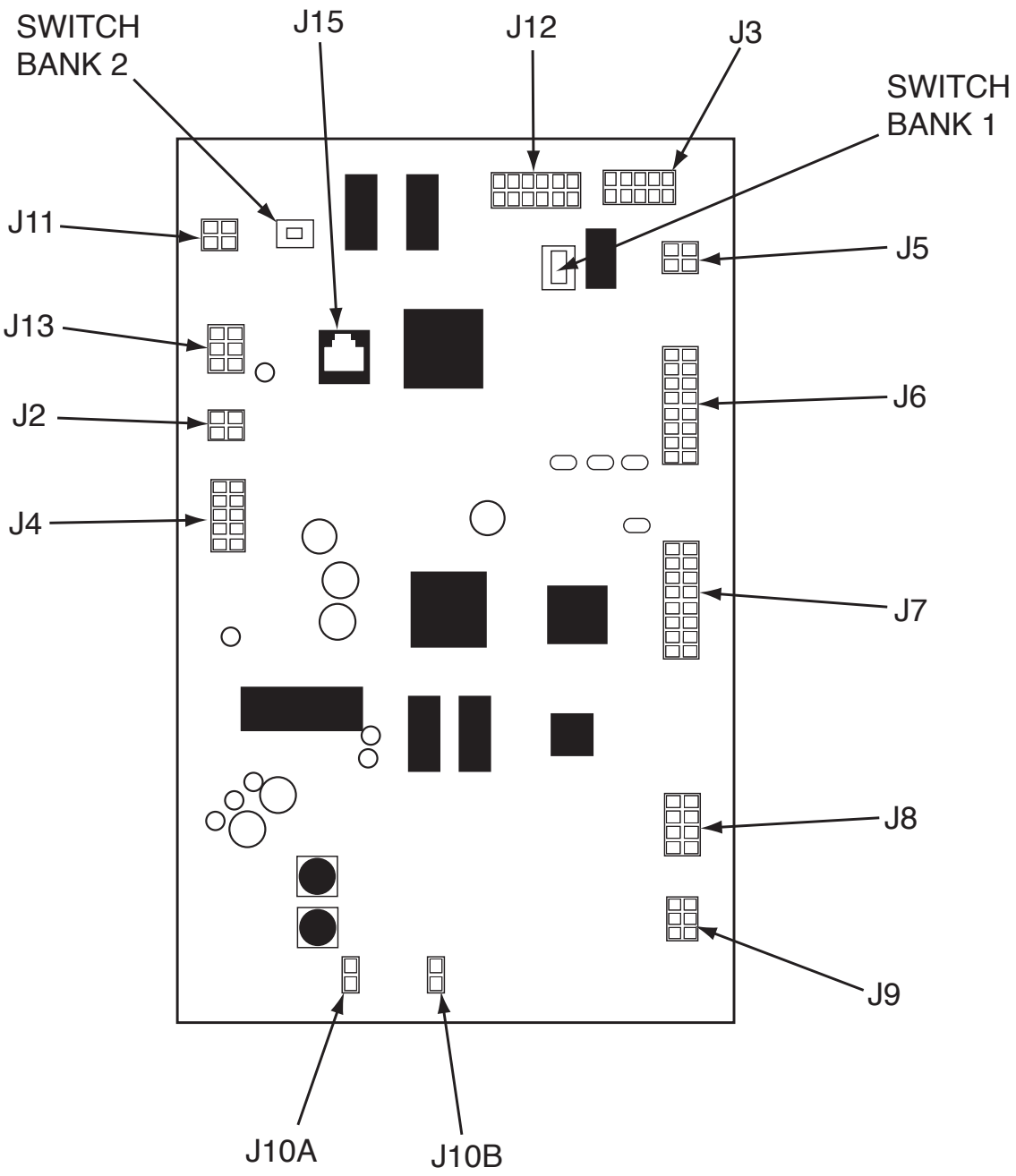
G4800 Digital Control PC Board Status LED's

LED #	COLOR	STATUS	FUNCTION
* 1	Green	See Table	Board Status Indicators Solid Green indicates OK (See IM or SVM for error codes)
2	Red	See Table	
3	Green	ON	Output Enable True (threshold determined by weld mode)
		OFF	Output Enable False (threshold determined by weld mode)
4	Green	ON	Single Phase Operation Detected (not valid for i400)
		OFF	Three Phase Operation Detected
5	Green	ON	Remote Electrode Voltage Sense Active (67 Lead)
		OFF	Electrode Voltage Sensed from Output Stud
6	Green	ON	Remote Work Voltage Sense Active (21 Lead)
		OFF	Work Voltage Sensed from Output Stud
* 7	Green	ON	Ethernet Physically connected to network or PC
		FLASH	Ethernet Physically connected and communicating
		OFF	No Ethernet Connection
* 8	Green	ON	Ethernet Speed = 100 Mb (default)
		OFF	Ethernet Speed = 10 Mb
* 9	Green	ON	On Board Power Supply Active (derived from 40V bus)
		OFF	On Board Power Supply Inactive
10	Green	ON	External DeviceNet Supply Connected
		OFF	External DeviceNet Supply Connected

* Critical for Ethernet based Systems.

CONTROL BOARD TEST PROCEDURE (continued)

FIGURE F.26 – CONTROL BOARD TEST POINTS



CONTROL BOARD TEST PROCEDURE (continued)

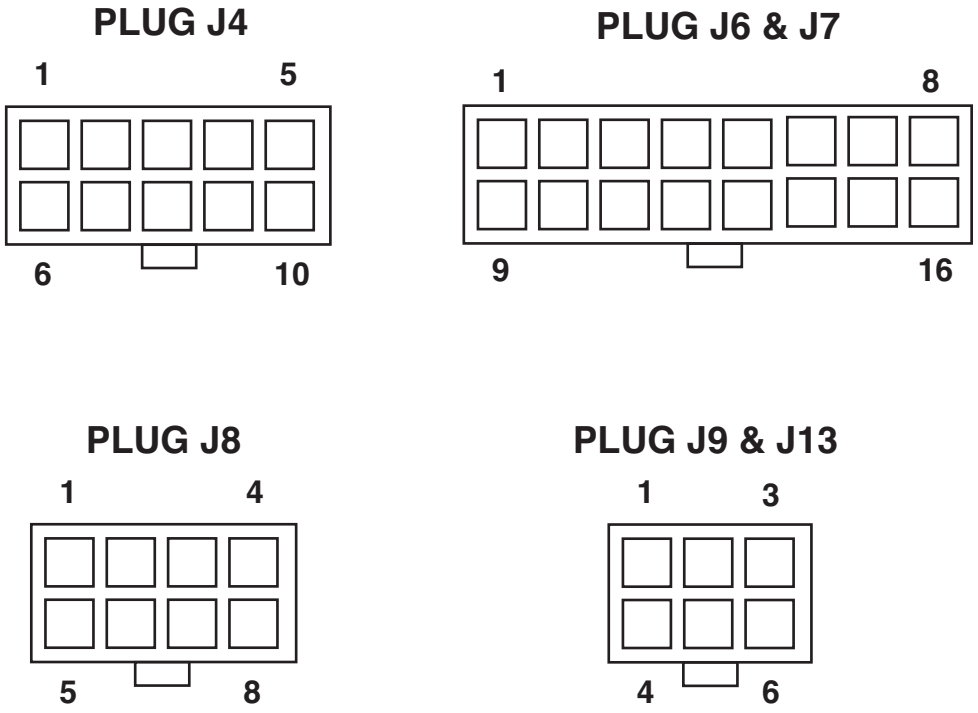
TABLE F.11

TEST POINTS	EXPECTED READINGS	CONDITIONS	COMMENTS
Plug J4 pin 1(+) to Plug J4 pin 2(-)	+40VDC	Input Power Applied	Control Board Supply
Plug J6 pin 9(+) to Plug J8 pin 6(-)	+15VDC	Input Power Applied	Input Board Supply
Plug J8 pin 2(+) to Plug J8 pin 6(-)	+15VDC	Input Power Applied	Current Transducer Supply
Plug J8 pin 6(+) to Plug J8 pin 4(-)	-15VDC	Input Power Applied	Current Transducer Supply
Plug J4 pin 10(+) to Plug J6 pin 11(-)	+15VDC	Input Power Applied	Switch Board Supply
Plug J7 pin 15(+) to Plug J7 pin 16(-)	12 TO 15VDC	Input Power Applied	Present When Fan Is Activated
Plug J13 pin 5(+) to Plug J13 pin 2(-)	+24VDC	Input Power Applied	Device Net Supply
Plug J6 pin 16(+) to Plug J6 pin 8(-)	8Hz./Volt Typically 325VDC =2.60kHz.	Input Power Applied	Filter Capacitor Voltage To Frequency Converter
Plug J6 pin 5(+) to Plug J6 pin 10(-)	8Hz./Volt Typically 325VDC =2.60kHz.	Input Power Applied	Filter Capacitor Voltage To Frequency Converter
Plug J9 pin 1 to Positive Output Terminal	ZERO RESISTANCE	Input Power Removed	Positive Voltage Sensing
Plug J9 pin 3 to Negative Output Terminal	ZERO RESISTANCE	Input Power Removed	Negative Voltage Sensing

Return to Section TOC
Return to Master TOC

CONTROL BOARD TEST PROCEDURE (continued)

FIGURE F.27 PLUGS J4,J6,J7,J8,J13 & J9



Return to Section TOC
Return to Master TOC

INPUT RECTIFIER REMOVAL AND REPLACEMENT PROCEDURE

⚠ WARNING

Service and repair should be performed by only Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment may result in danger to the technician or machine operator and will invalidate your factory warranty. For your safety and to avoid electrical shock, please observe all safety notes and precautions detailed throughout this manual.

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-888-935-3877.

DESCRIPTION

This procedure will aid the technician in the removal and replacement of the input rectifier module.

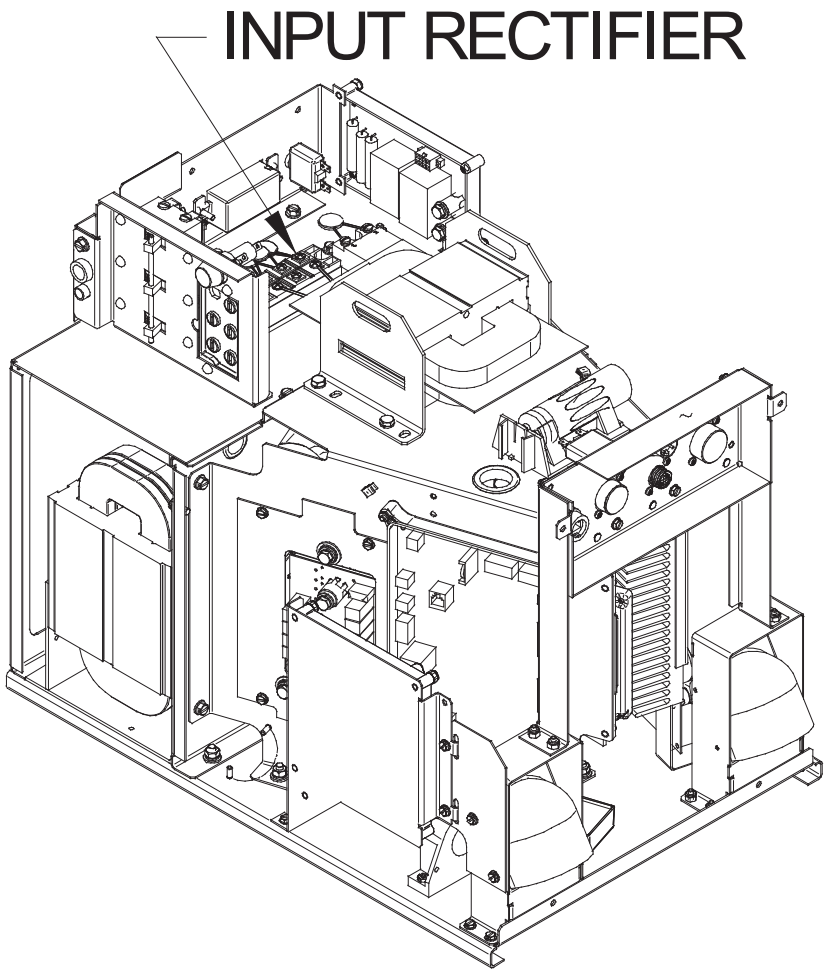
MATERIALS NEEDED

#25 Torx Screw Driver
Phillips Screw Driver.
Penetrox A13
RTV Sealant

Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC

INPUT RECTIFIER REMOVAL AND REPLACEMENT PROCEDURE (continued)

FIGURE F.28 INPUT RECTIFIER LOCATION



PROCEDURE

1. Remove input power to the power wave i 400.

2. Perform the ***Chassis Removal and Capacitor Discharge Procedure.***

3. Locate and remove the RTV sealant from the input rectifier connection terminals. Refer to figure F.28.

4. Label leads and using a Phillips screwdriver carefully remove the (6) leads from the input rectifier terminals. Note placement for reassembly. See ***Figure F.29.***

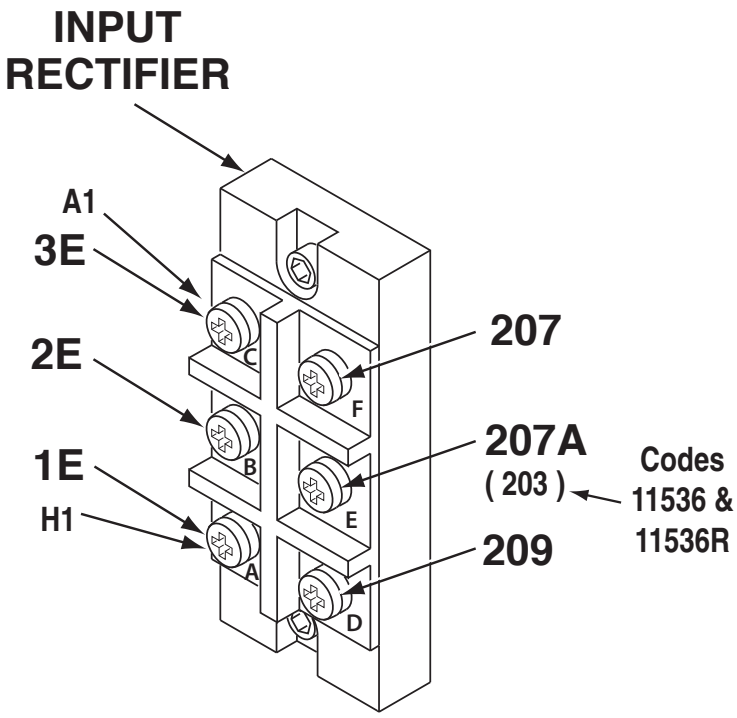
5. Using a #25 Torx screw driver remove the two mounting screws and washers from the rectifier module.

6. Carefully remove the Rectifier Module from the heat sink.

Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC

INPUT RECTIFIER REMOVAL AND REPLACEMENT PROCEDURE (continued)

FIGURE F.29 INPUT RECTIFIER CONNECTION POINTS



REPLACEMENT PROCEDURE

1. Clean heat sink surface.

2. Apply an even coating (0.002in/0.005 in thick) of joint compound (Penetrox A-13- LE Co. # T12837-1) to both the heat sink and the Rectifier Module mounting surfaces.

3. Mount the module to the heat sink and evenly torque the mounting screws(with washers) to 44 in/lbs.

4. Assemble the leads to the correct module terminals and torque to 26 in/lbs.

5. Apply RTV sealant to the rectifier connection terminals.

Return to Section TOC
Return to Master TOC

NOTES

F-72

Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC

CURRENT TRANSDUCER REMOVAL AND REPLACEMENT PROCEDURE

⚠ WARNING

Service and repair should be performed by only Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment may result in danger to the technician or machine operator and will invalidate your factory warranty. For your safety and to avoid electrical shock, please observe all safety notes and precautions detailed throughout this manual.

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-888-935-3877.

DESCRIPTION

The procedure will aid the technician in the removal and replacement of the Current Transducer.

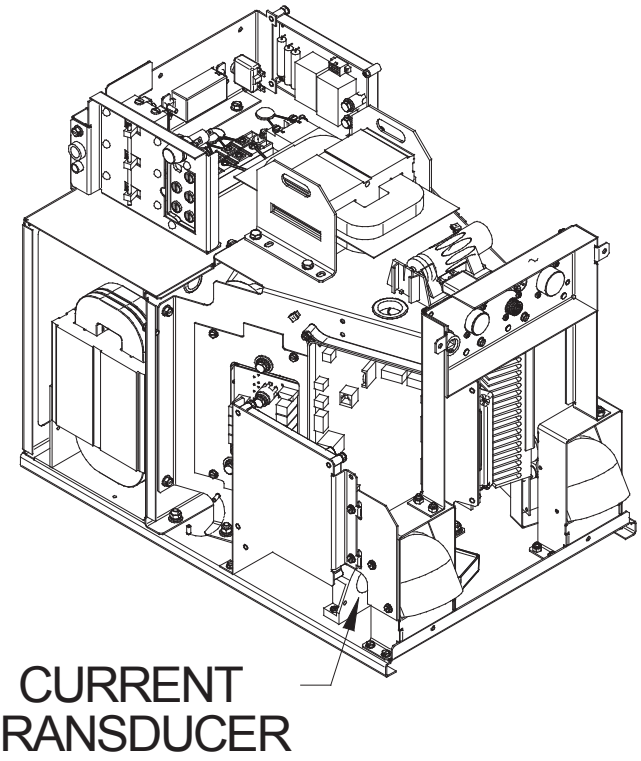
MATERIALS NEEDED

5/16 inch Wrench
11/32 inch Wrench
3/4 inch Wrench

Return to Section TOC
Return to Master TOC

CURRENT TRANSDUCER REMOVAL AND REPLACEMENT PROCEDURE (continued)

FIGURE F.30 CURRENT TRANSDUCER LOCATION



REMOVAL PROCEDURE

1. Remove the input power to the Power Wave i-400 machine.
2. Perform the ***Chassis Removal and Capacitor Discharge Procedure***.
3. Locate the Current Transducer. See Figure F.30.
4. For easier access to the Current Transducer remove the screws holding the Wire Drive Board to the chassis. See the ***Wire Drive Board Removal and Replacement Procedure.***
5. Using the ¾ inch wrench remove the bolt and washers holding the positive output lead and two flex leads (901 and 901B) from the output terminal.
6. Carefully slide the positive output lead thru the hole in the Current Transducer.
7. Carefully remove the four pin Molex plug from the Current Transducer.
8. Using the 11/32 inch wrench remove the two nuts and washers mounting the Current Transducer to the chassis. Note the direction of the positive + arrow on the Current Transducer.

Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC

CURRENT TRANSDUCER REMOVAL AND REPLACEMENT PROCEDURE (continued)

REPLACEMENT PROCEDURE:

1. Place current transducer in chassis over the mounting screws and replace the two 11/32 washers and nuts. NOTE DIRECTION OF POSITIVE + ARROW

2. Replace the four pin Molex plug to the current transducer.

3. Thread the positive output lead thru the hole in the Current Transducer and reconnect it along with the two flex leads (901 and 901B) to the output terminal.

4. Remount the Wire Drive Board to the chassis.

Return to Section TOC
Return to Master TOC

NOTES

F-76

Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC

INPUT BOARD REMOVAL AND REPLACEMENT PROCEDURE

⚠ WARNING

Service and repair should be performed by only Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment may result in danger to the technician or machine operator and will invalidate your factory warranty. For your safety and to avoid electrical shock, please observe all safety notes and precautions detailed throughout this manual.

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-888-935-3877.

DESCRIPTION

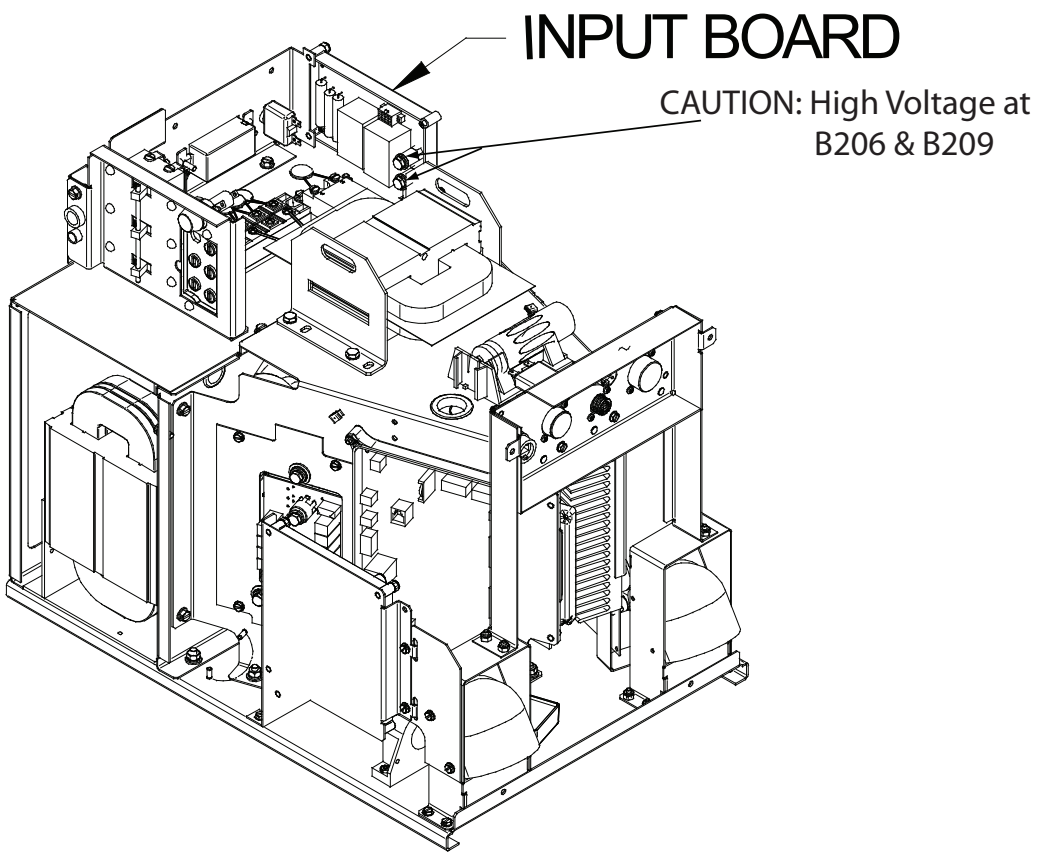
This procedure will aid the technician in the removal and replacement of the Input Circuit Board.

MATERIALS NEEDED

7/16 inch wrench
3/8 inch wrench

INPUT BOARD REMOVAL AND REPLACEMENT PROCEDURE (continued)

FIGURE F.31 INPUT BOARD LOCATION



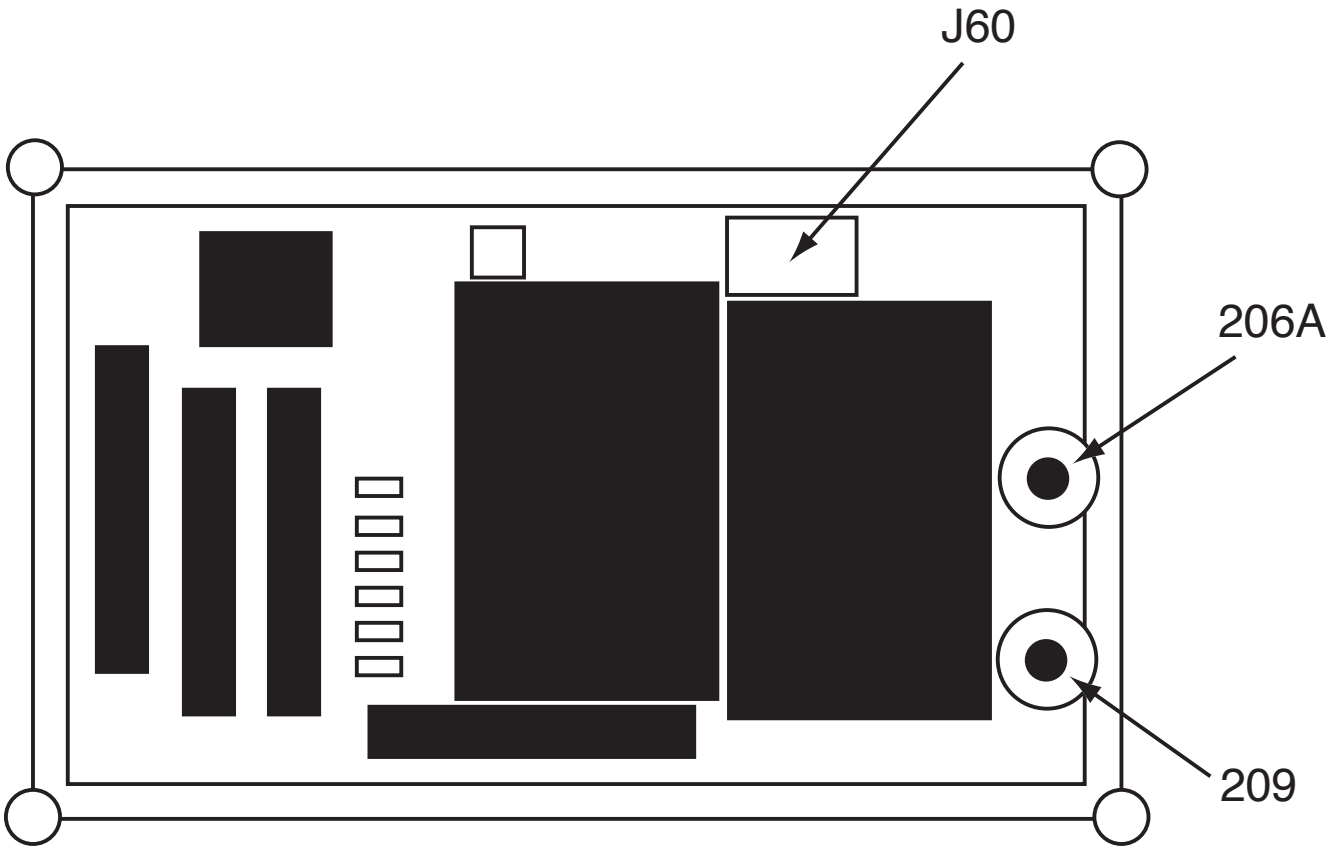
REMOVAL PROCEDURE

1. Remove the input power to the Power Wave i-400 machine.
2. Perform the ***Chassis Removal and Capacitor Discharge Procedure.***
3. Locate the Input Board See Figure F.31.
4. Using 7/16 inch wrench disconnect leads 206A and 209 from the Input Board. See ***Figure F.32.***
5. Disconnect Plug J60. See ***Figure F.32.***
6. Using a 3/8 inch wrench take off the (3) nuts holding the circuit board to the chassis.

Return to Section TOC
Return to Master TOC

INPUT BOARD REMOVAL AND REPLACEMENT PROCEDURE (continued)

FIGURE F.32 INPUT BOARD LEAD LOCATIONS



REPLACEMENT PROCEDURE:

1. Install the Input Board to the chassis using the 3/8 inch nuts previously removed.

2. Reconnect leads 206A and 209 to their correct terminals.

3. Reconnect plug J-60 to the Input Board.

Return to Section TOC
Return to Master TOC

NOTES

Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC

DC BUS BOARD REMOVAL AND REPLACEMENT PROCEDURE

⚠ WARNING

Service and repair should be performed by only Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment may result in danger to the technician or machine operator and will invalidate your factory warranty. For your safety and to avoid electrical shock, please observe all safety notes and precautions detailed throughout this manual.

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-888-935-3877.

DESCRIPTION

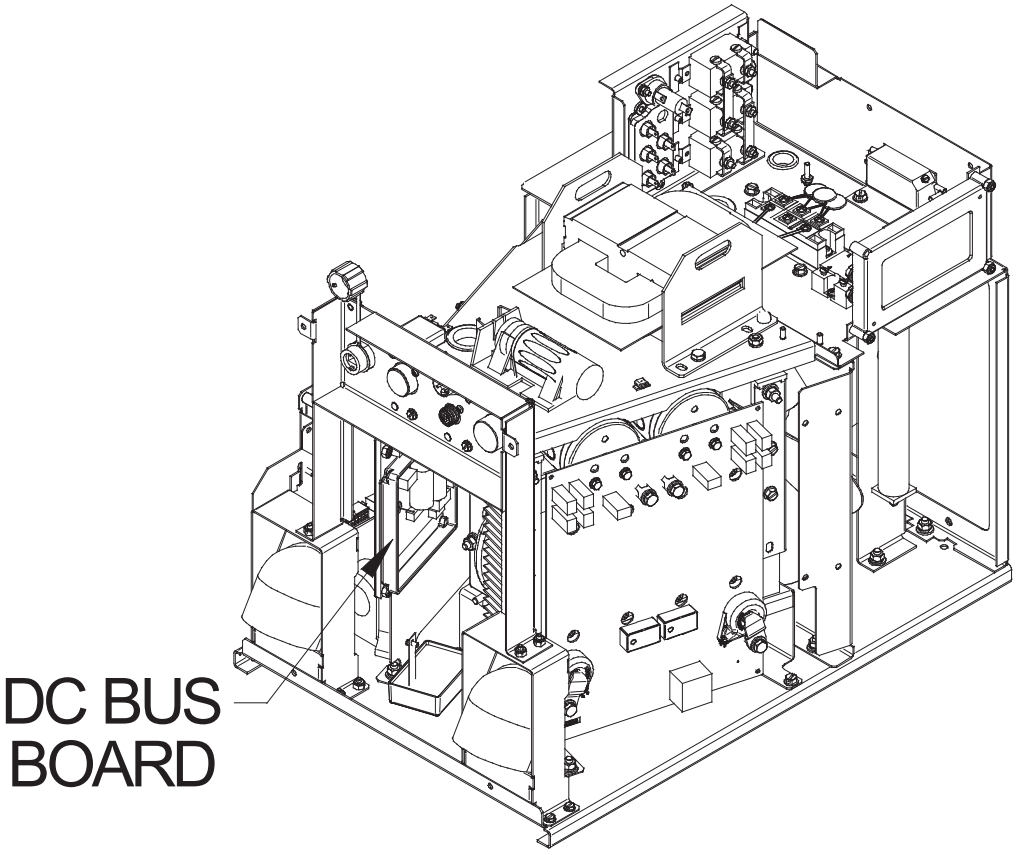
The procedure will aid the technician in the removal and replacement of the DC Bus Board.

MATERIALS NEEDED

3/8 inch Wrench and Nut Driver
Phillips Screw Driver
Penetrox A-13

DC BUS BOARD REMOVAL AND REPLACEMENT PROCEDURE (continued)

FIGURE F.33 DC BUS BOARD LOCATION

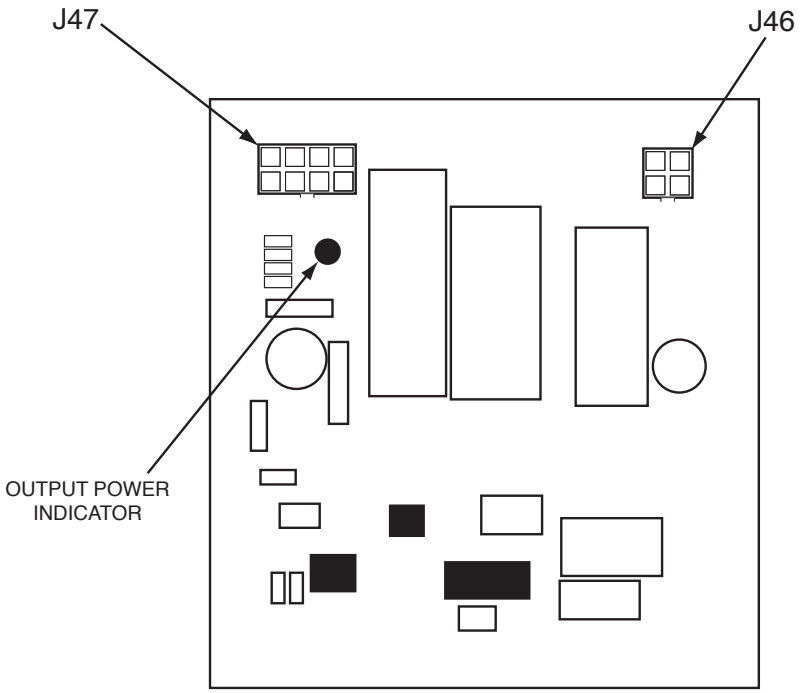


REMOVAL PROCEDURE:

1. Remove the input power to the Power Wave i-400 machine.
2. Perform the ***Chassis Removal and Capacitor Discharge Procedure.***
3. Locate the DC Bus Board. See Figure F.33.
4. Using the 3/8 inch wrench remove the three 3/8 inch nuts holding DC Bus Board to chassis.
5. Unplug leads 41,42,65B and 66B from DC Bus Rectifier. Marking all leads as to location on the Bus Rectifier.
6. Using the 3/8 inch nut driver remove the DC Bus Rectifier from the heat sink.
7. Remove plugs J-46 and J- 47 and mark for replacement. See ***Figure F.34.***
8. Remove leads 503 and 504 from Thermostat and mark for reassembly.
9. Remove the thermostat from the heat sink using the Phillips screwdriver.

DC BUS BOARD REMOVAL AND REPLACEMENT PROCEDURE (continued)

FIGURE F.34 DC BUS BOARD LEAD LOCATION



REPLACEMENT PROCEDURE:

1. Mount the thermostat to the DC Bus board heat sink using the two Phillips head screws previously removed. Apply a thin coating (.002 - .005 in.) of Penetrox A13 to the mounting surface.

2. Mount the DC Bus Rectifier to the heat sink. Apply a thin coating (.002 - .005 in.) of Penetrox A13 to the mounting surface.

3. Reconnect leads 503 and 504 to the thermostat.

4. Reconnect leads 41, 42, 65B and 66B to the DC Bus Rectifier. Make certain the leads are in the correct position.

5. Install the DC Bus Board into the chassis and secure with the three 3/8 inch nuts previously removed.

6. Reconnect plugs J46 and J47 to the DC Bus Board.

Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC

NOTES

F-84

Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC

WIRE DRIVE BOARD (FEED HEAD BOARD) REMOVAL AND REPLACEMENT PROCEDURE

⚠ WARNING

Service and repair should be performed by only Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment may result in danger to the technician or machine operator and will invalidate your factory warranty. For your safety and to avoid electrical shock, please observe all safety notes and precautions detailed throughout this manual.

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-888-935-3877.

DESCRIPTION

This procedure will aid the technician in the removal and replacement of the Wire Drive Board, (Feed Head Board)

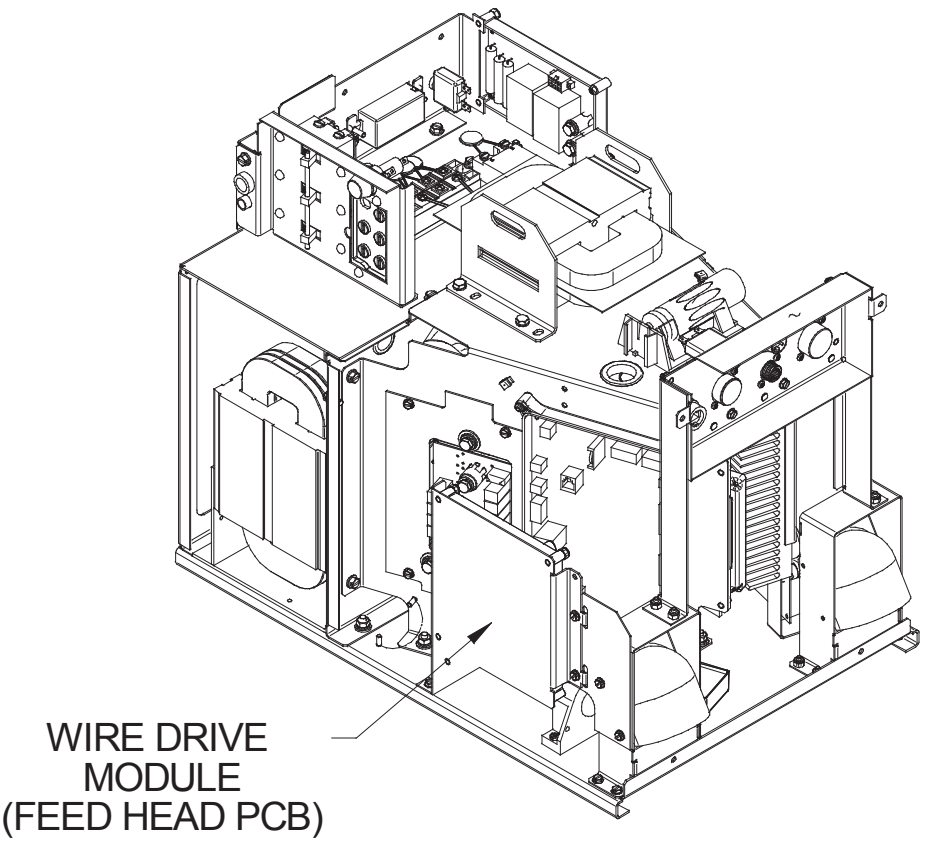
MATERIALS NEEDED

5/16 inch nut driver
3/8 inch nut driver

Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC

WIRE DRIVE BOARD (FEED HEAD BOARD) REMOVAL AND REPLACEMENT PROCEDURE (continued)

FIGURE F.35 WIRE DRIVE BOARD (FEED HEAD BOARD) LOCATION



REMOVAL PROCEDURE:

1. Remove the input power to the Power Wave i-400 machine.

2. Perform the ***Chassis Removal and Capacitor Discharge Procedure.***

3. Locate the Wire Drive Board. See Figure F.35.

4. Using the 5/16 inch nut driver remove the three screws holding the Wire Drive Board bracket to the chassis.

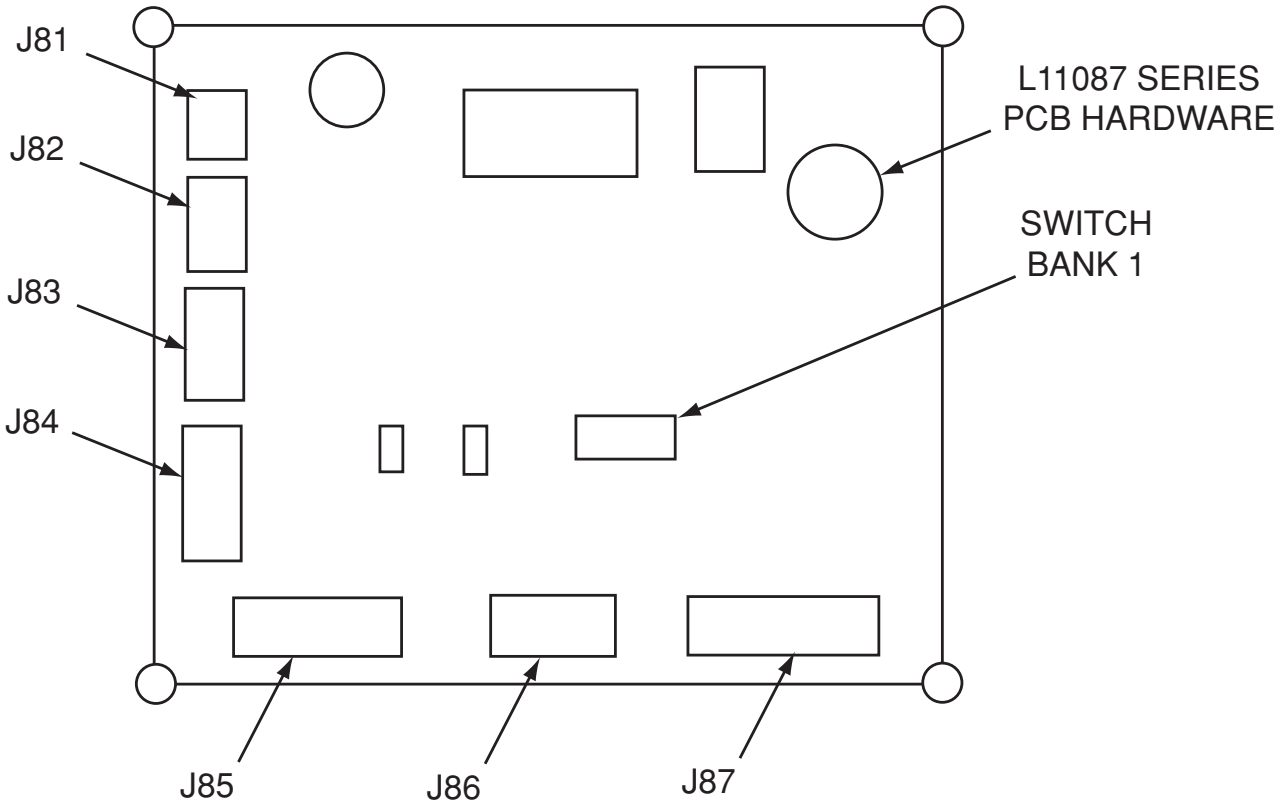
5. Using the 3/8 inch nut driver remove the circuit board by removing the three 3/8 inch nuts from board bracket.

6. Carefully Remove plugs J 82 , J83 , J84 and J85. See ***Figure F.36.***

Note: Diode Module removal is not necessary. If removed, be sure to mark location of leads for reassembly.

WIRE DRIVE BOARD (FEED HEAD BOARD) REMOVAL AND REPLACEMENT PROCEDURE (continued)

FIGURE F.36 WIRE DRIVE BOARD (FEED HEAD BOARD) LEAD LOCATION



PROCEDURE

1. Place circuit board in board bracket and replace the three 3/8 inch nuts previously removed.

2. Reconnect all Plugs previously removed. See Figure F.36.

3. Replace bracket to chassis with the three screws previously removed.

Return to Section TOC
Return to Master TOC

NOTES

Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC

CONTROL BOARD REMOVAL AND REPLACEMENT PROCEDURE

⚠ WARNING

Service and repair should be performed by only Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment may result in danger to the technician or machine operator and will invalidate your factory warranty. For your safety and to avoid electrical shock, please observe all safety notes and precautions detailed throughout this manual.

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-888-935-3877.

DESCRIPTION

The procedure will aid the technician in the removal and replacement of the Control Board.

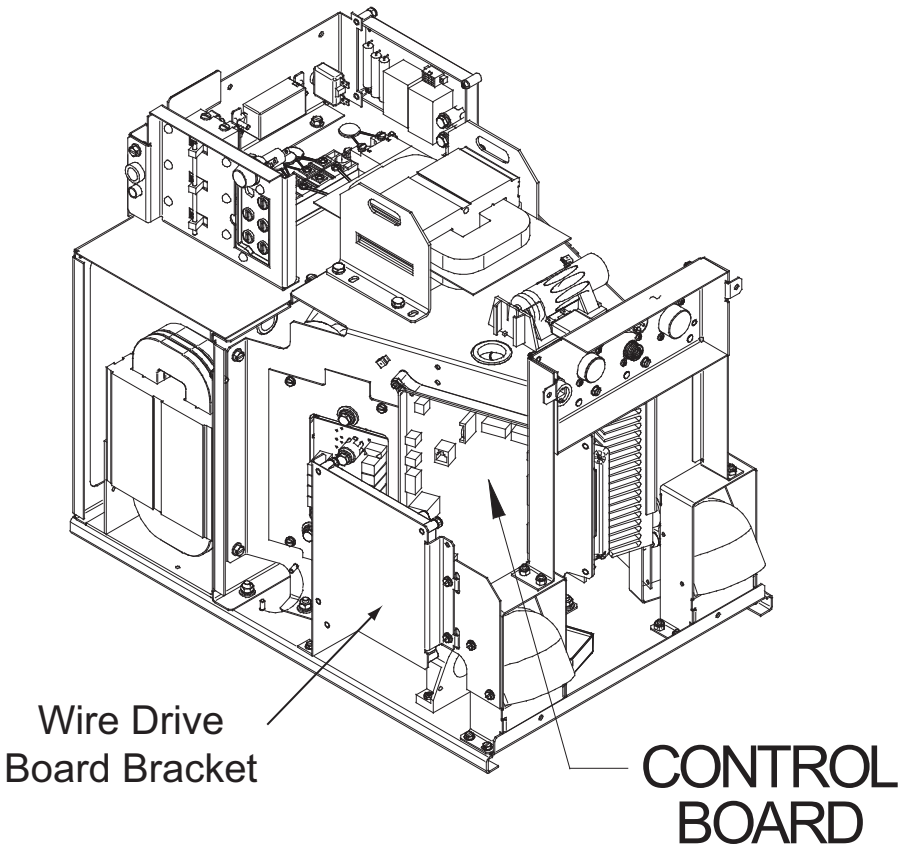
MATERIALS NEEDED

5/16 inch Wrench
3/8 inch Wrench

Return to Section TOC
Return to Master TOC

CONTROL BOARD REMOVAL AND REPLACEMENT PROCEDURE (continued)

FIGURE F.37 CONTROL BOARD LOCATION



REMOVAL PROCEDURE:

1. Remove the input power to the Power Wave i-400 machine.

2. Perform the ***Chassis Removal and Capacitor Discharge Procedure.***

3. Locate the Control Board. See Figure F.37.

4. For easier access remove the three screws holding the Wire Drive Board Bracket to the chassis and move aside. See ***Wire Drive Board Removal and Replacement Procedure.***

5. Remove all of the Molex plugs and the Ethernet Plug from the Control Board. Note locations for reassembly. See ***Figure F.38.***

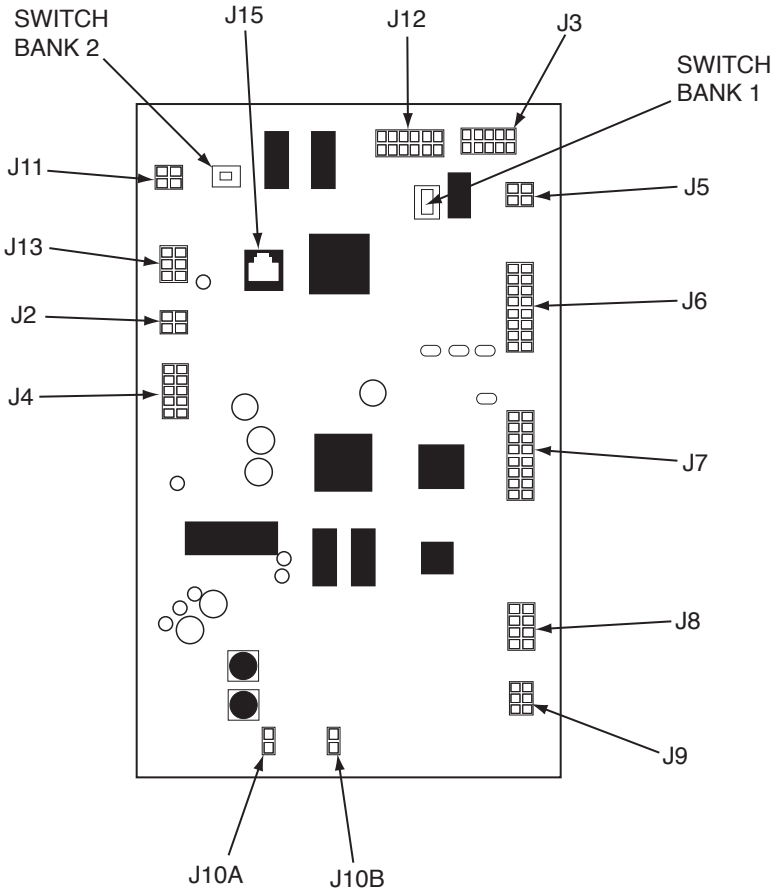
6. Using the 3/8 inch wrench remove the three nuts mounting the Control Board to the chassis.

7. Carefully remove the Control Board.
   - Pull the left side of the Control Board off of the studs.
   - Rotate the board up to the left and pull it off of the upper right hand stud.

Return to Section TOC
Return to Master TOC

CONTROL BOARD REMOVAL AND REPLACEMENT PROCEDURE (continued)

FIGURE F.38 CONTROL BOARD LEAD LOCATION



REPLACEMENT PROCEDURE:

1. Place the Control Board into the chassis and secure with the three 3/8 inch nuts previously removed.

2. Replace all of the Molex plugs and the Ethernet plug.

3. Replace the Wire Drive Board Bracket.

Return to Section TOC
Return to Master TOC

NOTES

F-92

Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC

SWITCH BOARD & FILTER CAPACITOR REMOVAL AND REPLACEMENT PROCEDURE

⚠ WARNING

Service and repair should be performed by only Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment may result in danger to the technician or machine operator and will invalidate your factory warranty. For your safety and to avoid electrical shock, please observe all safety notes and precautions detailed throughout this manual.

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-888-935-3877.

DESCRIPTION

The procedure will aid the technician in the removal and replacement of the main switch board and filter capacitors.

MATERIALS NEEDED

T-25 Torx driver
Phillips Screw Driver
7/16 Inch Wrench
In-lbs Torque Wrench
Dow 340 Thermal Grease

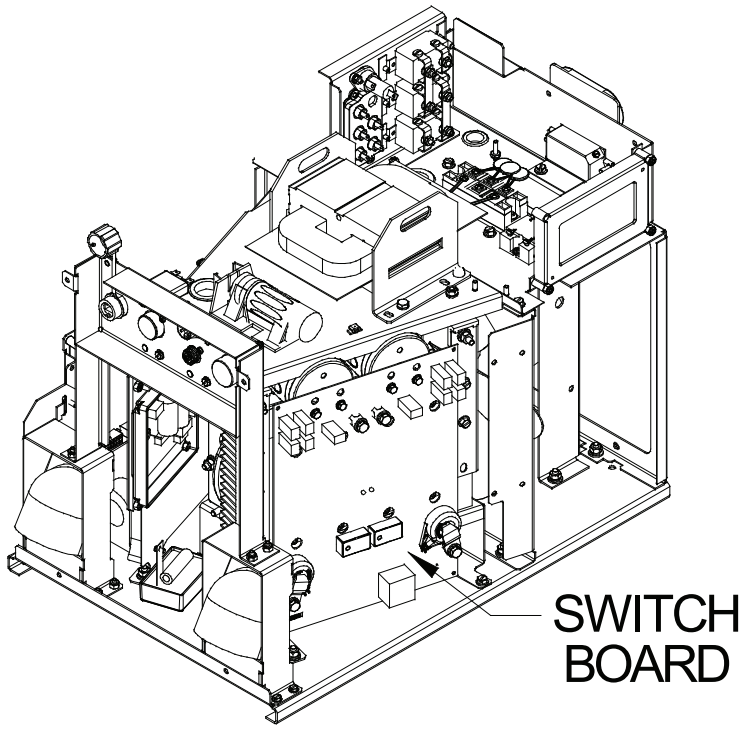
CAUTION: THE PC BOARD CAN BE DAMAGED BY STATIC ELECTRICITY

Remove your body`s static charge before opening the chassis. Wear an anti-static wrist strap. For safety use a 1 Meg ohm resistive cord connected to a grounded part of the equipment frame. If you don t have a wrist strap, touch an unpainted, grounded, part of the equipment frame. Keep touching the frame to prevent static build-up. Be sure not to touch any electrically live parts at the same time. Tools which come in contact with the PC Board must be either conductive, anti-static or static-dissipative.

Return to Section TOC
Return to Master TOC

SWITCH BOARD & FILTER CAPACITOR REMOVAL AND REPLACEMENT PROCEDURE (continued)

FIGURE F.39 SWITCH BOARD LOCATION



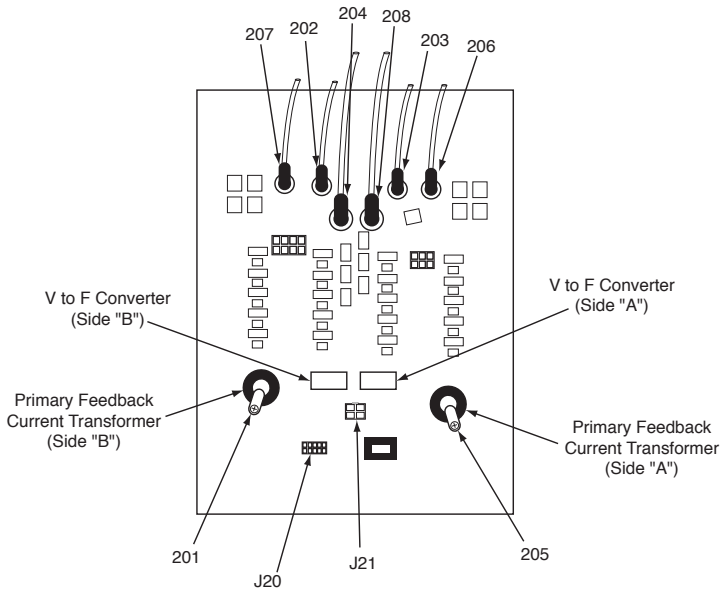
REMOVAL PROCEDURE:

1. Remove all input power to the Power Wave I 400.
2. Perform the ***Chassis Removal and Capacitor Discharge Procedure.***
3. Locate the Switch Board. See Figure F.39.
4. Remove Molex plugs J20 and J21 from the Switch Board. See ***Figure F.40.***
5. Using the Phillips screw driver remove Leads 207,202,203,206. See ***Figure F.40.***
6. Using the 7/16 inch wrench remove leads 204,208,201,205. See ***Figure F.40***.
7. Using the T-25 Torx Driver remove the eight Torques screws securing the Switch Board to the Heat Sink.
8. Carefully remove the Switch Board from the heat sink.

Return to Section TOC
Return to Master TOC

SWITCH BOARD & FILTER CAPACITOR REMOVAL AND REPLACEMENT PROCEDURE (continued)

FIGURE F.40 SWITCH BOARD LEAD LOCATION



REPLACEMENT PROCEDURE:

1. If the filter capacitors are to be replaced, carefully slide the new capacitors into the mounting bracket. Position the capacitor so the correct polarity terminal is lined up with the correct hole on the switch board.

2. Included with the replacement part are one or more tubs of thermal grease or electrical joint compound for various electrical connections. See Table below for the Lincoln Electric part numbers. **Do Not** use thermal grease where electrical joint compound is used, or electrical joint compound where thermal grease is used.

3. Before installing the new PC Board, the original thermal grease or electrical joint compound must be completely removed from the heat sink. Clean the heat sink mating surface and the devices surface with mineral spirits, then with isopropyl alcohol. Be sure not to scratch or mark the heat sink surface when removing the old material. Apply a heavy coating of thermal grease or electrical joint compound to the mating surfaces of the electrical modules and the heat sink.

4. If supplied the electrical joint compound needs to be applied as a thin coating to the various electrical connections, such as the capacitor terminals. If removing the capacitors, be sure to observe polarity of the terminals when reassembling.

   If there are any questions, please feel free to contact the Lincoln Electric Service Department, we will be happy to assist you.

   Call: 1- 888 -935- 3877

5. Mount the new Switch Board and tighten the eight Torques screws with lock washers in the following manner. Tighten all until snug, Tighten all from 24-28 inch pounds, then tighten all from 40-48 inch pounds.

PART NUMBER	DESCRIPTION
T12837	Dow 340 Thermal Grease (White)
T12837-1	Penetrox Electrical Joint Compound (Gray)

6. Make sure the capacitors are positioned correctly. Connect leads 207, 202,203 and 206 to the correct terminals. See Figure F.40. for connection locations. Tighten all four to 55 in-lbs.

7. Position and mount the four leads 204, 208,201, and 205. See Figure F.40 for connection locations.

8. Reconnect plugs J20 and J21.

NOTES

Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC

OUTPUT RECTIFIER REMOVAL AND REPLACEMENT PROCEDURE

⚠ WARNING

Service and repair should be performed by only Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment may result in danger to the technician or machine operator and will invalidate your factory warranty. For your safety and to avoid electrical shock, please observe all safety notes and precautions detailed throughout this manual.

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-888-935-3877.

DESCRIPTION

The procedure will aid the technician in the removal and replacement of the Output Rectifier Assembly.

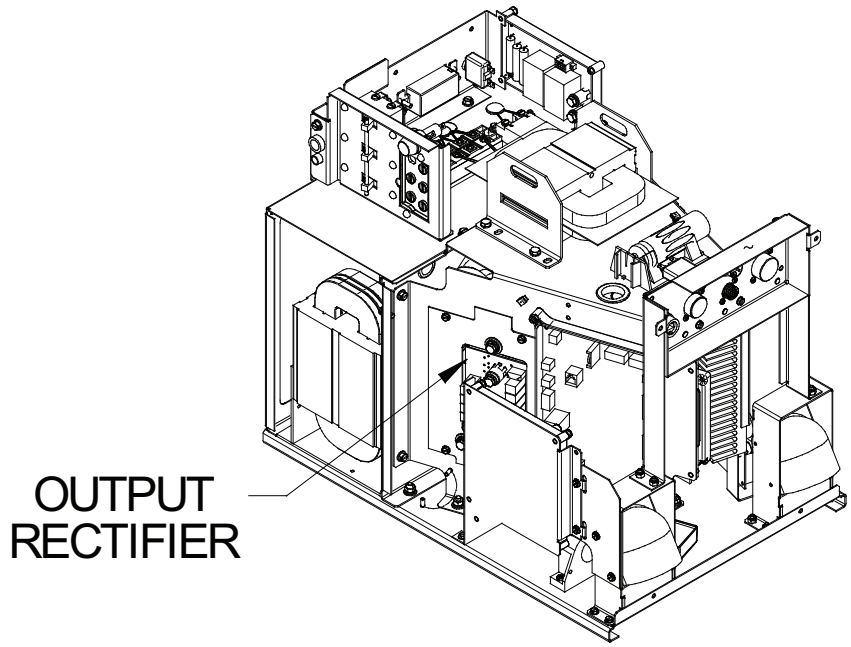
MATERIALS NEEDED

7/16 Inch Wrench
5/16 Inch Wrench
1/2 Inch Wrench
Phillips Screw Driver
Penetrox A 13

Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC

OUTPUT RECTIFIER REMOVAL AND REPLACEMENT PROCEDURE (continued)

FIGURE F.41 – OUTPUT RECTIFIER LOCATION



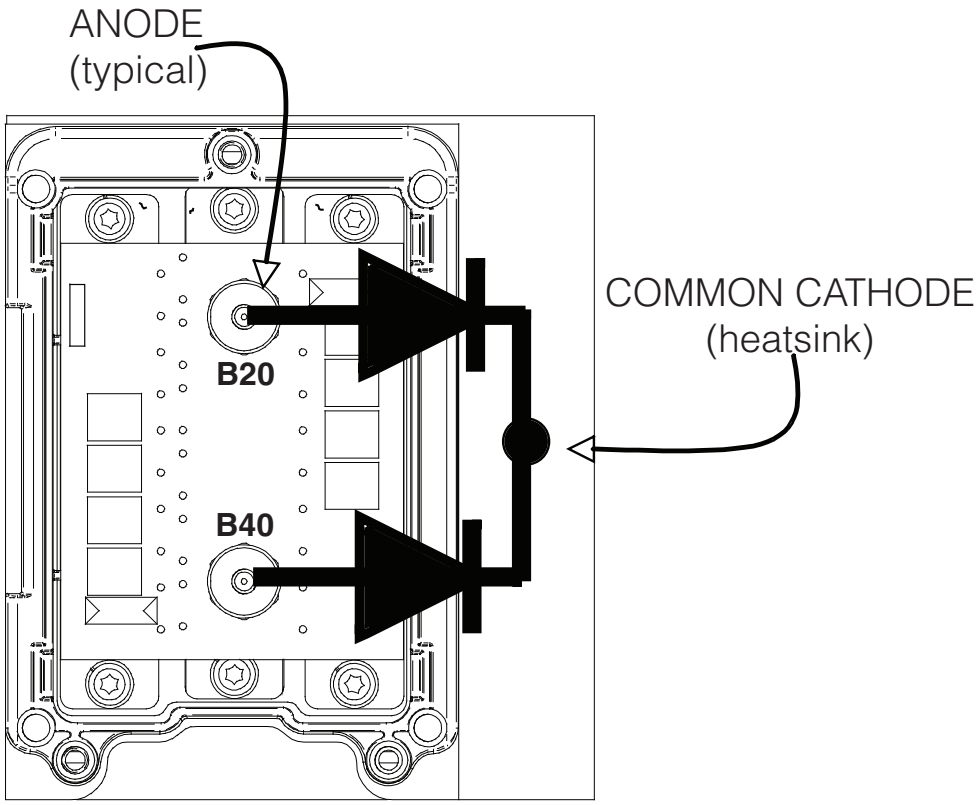
REMOVAL PROCEDURE:

1. Remove the input power to the I-400 machine.
2. Perform the ***Chassis Removal and Capacitor Discharge Procedure.***
3. Locate the Output Rectifier Board. See Figure F.41
4. Using a 5/16 inch wrench remove the three screws holding the Wire Drive Board bracket to the chassis. See the ***Wire Drive Board Removal and Replacement Procedure.***
5. Using the 7/16 inch wrench remove the two screws and washers mounting leads B20 and B40 to the Output Rectifier Board. Label leads for reassembly. See ***Figure F.42.***
6. Using the 5/16 inch wrench remove the four screws from the Output Rectifier Bracket.
8. Disconnect the two thermostat leads. (Leads 504 and 505)
9. Carefully remove the Output Rectifier and heat sink assembly from the chassis.
10. Using the ½ inch wrench remove the white flex lead 901A and the positive output lead (heavy black lead) from the heat sink.
11. Using the Phillips screw driver remove the thermostat.

Return to Section TOC
Return to Master TOC

OUTPUT RECTIFIER REMOVAL AND REPLACEMENT PROCEDURE (continued)

FIGURE F.42 OUTPUT RECTIFIER LEAD LOCATIONS



REPLACEMENT PROCEDURE

1. Attach the positive output lead and the 901 flex lead to the heat sink. Use Penetrox A-13 on this connection.
2. Attach the thermostat to the top of the heat sink using two Phillips screws.
3. Carefully position the Output Rectifier into the chassis.
4. Reconnect the thermostat leads. (Leads 504 and 505)
5. Attach the Output Rectifier to the mounting bracket using the three screws previously removed. Place the insulated washers next to the mounting bracket, then the plain washers and lock washers to secure the mounting bracket to the Output Rectifier.
6. Using the 5/16 inch wrench secure the mounting bracket to the chassis with the four screws previously removed.
7. Reconnect the two leads B20 and B40 to the proper locations as marked from disassembly.
8. Replace the Wire Drive Board Bracket to the chassis.

Return to Section TOC
Return to Master TOC

NOTES

Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC

Return to Section TOC
Return to Master TOC

RETEST AFTER REPAIR

⚠ WARNING

Service and repair should be performed by only Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment may result in danger to the technician or machine operator and will invalidate your factory warranty. For your safety and to avoid electrical shock, please observe all safety notes and precautions detailed throughout this manual.

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-888-935-3877.

DESCRIPTION

The procedure will aid the technician in testing the Powerwave i400 output after the repair or replacement of a part or pc board.

MATERIALS NEEDED

Diagnostic Utilities Software
Laptop or other Suitable Computer
Ethernet Cross Connect Cable (LE Co. # M19969-7)
Resistive Load Bank
Two (2) Welding Cables - 20ft. -4/0
Calibrated Ammeter and Voltmeter

TEST PROCEDURE

1. Be certain that the machine is properly connected for the input voltage being applied.
2. Turn the Power Switch ON and see that it goes through the Start-up routine and the Status Light is steady Green.
3. Turn the Power Switch OFF, connect a resistive load across the Output Studs and a computer to the Ethernet. Perform the ***Calibration Procedure*** to be sure that the machine will produce proper weld output.

NOTE: Welding and/or wire feed problems may still exist, but may only be evident after the machine is reconnected into the weld cell.

NOTES

F-102

Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC

TABLE OF CONTENTS - DIAGRAM SECTION

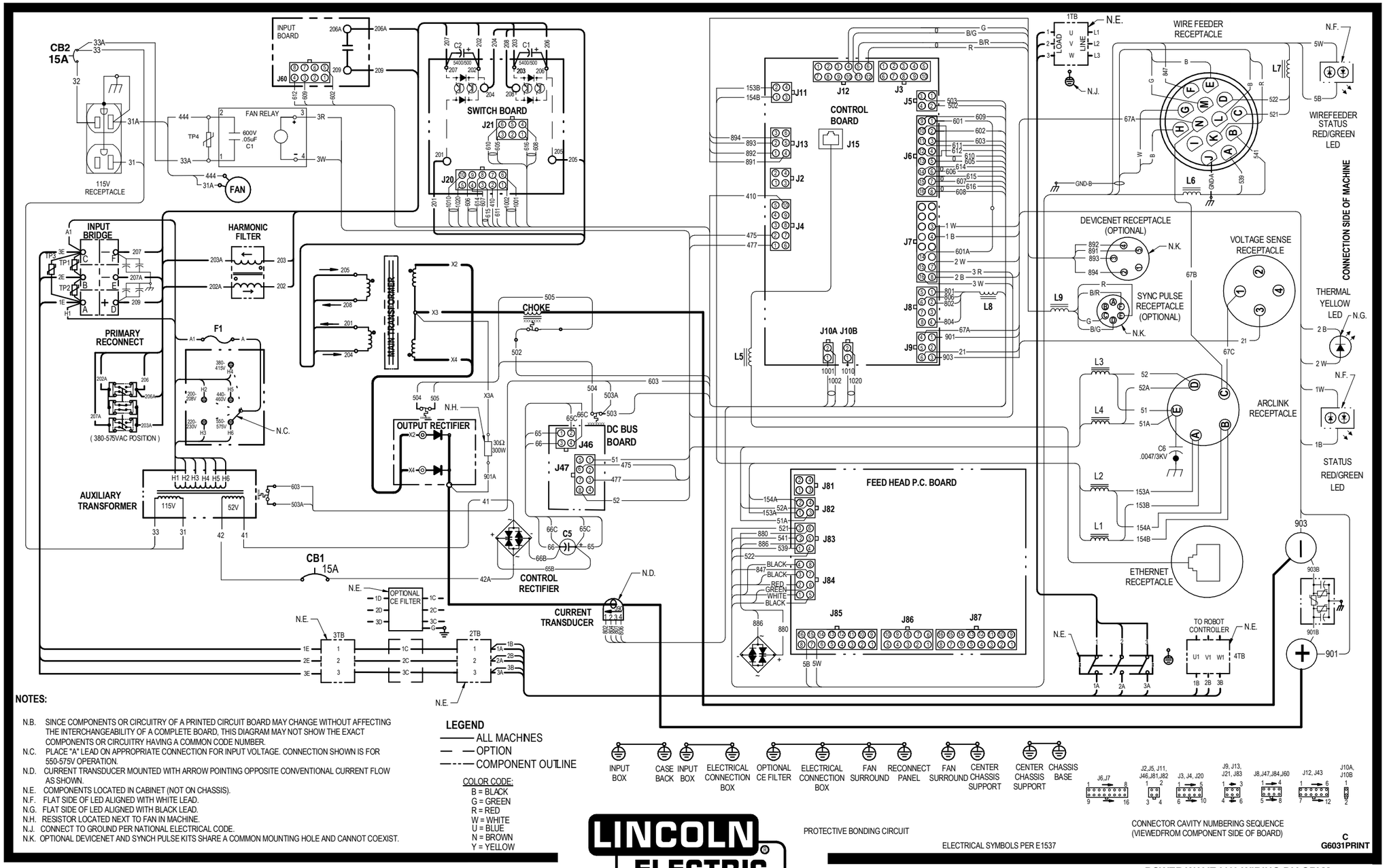
NOTE: Many PC Board Assemblies are now totally encapsulated, surface mounted and or multi-layered and are therefore considered to be unserviceable. Assembly drawings of these boards are no longer provided.

Return to Master TOC
Return to Master TOC
Return to Master TOC
Return to Master TOC

Return to Master TOC

WIRING DIAGRAM - CODES 11454, 11454R, 11945, 11774, 11774R - G6031

WIRING DIAGRAM - POWER WAVE i400



NOTES:

N.B. SINCE COMPONENTS OR CIRCUITRY OF A PRINTED CIRCUIT BOARD MAY CHANGE WITHOUT AFFECTING THE INTERCHANGEABILITY OF A COMPLETE BOARD, THIS DIAGRAM MAY NOT SHOW THE EXACT COMPONENTS OR CIRCUITRY HAVING A COMMON CODE NUMBER.
N.C. PLACE "A" LEAD ON APPROPRIATE CONNECTION FOR INPUT VOLTAGE. CONNECTION SHOWN IS FOR 550-575V OPERATION.
N.D. CURRENT TRANSDUCER MOUNTED WITH ARROW POINTING OPPOSITE CONVENTIONAL CURRENT FLOW AS SHOWN.
N.E. COMPONENTS LOCATED IN CABINET (NOT ON CHASSIS).
N.F. FLAT SIDE OF LED ALIGNED WITH WHITE LEAD.
N.G. FLAT SIDE OF LED ALIGNED WITH BLACK LEAD.
N.H. RESISTOR LOCATED NEXT TO FAN IN MACHINE.
N.J. CONNECT TO GROUND PER NATIONAL ELECTRICAL CODE.
N.K. OPTIONAL DEVICENET AND SYNCH PULSE KITS SHARE A COMMON MOUNTING HOLE AND CANNOT COEXIST.

LEGEND

——— ALL MACHINES
— — OPTION
– – – – COMPONENT OUTLINE

COLOR CODE:
B = BLACK
G = GREEN
R = RED
W = WHITE
U = BLUE
N = BROWN
Y = YELLOW

INPUT BOX | CASE BACK | INPUT BOX | ELECTRICAL CONNECTION BOX | OPTIONAL CE FILTER | ELECTRICAL CONNECTION BOX | FAN SURROUND | RECONNECT PANEL | FAN SURROUND | CENTER CHASSIS SUPPORT | CENTER CHASSIS SUPPORT | CHASSIS BASE

J6,J7 | J2,J5, J11, J46,J81,J82 | J3, J4, J20 | J9, J13, J21, J83 | J8,J47,J84,J60 | J12, J43 | J10A, J10B

CONNECTOR CAVITY NUMBERING SEQUENCE (VIEWEDFROM COMPONENT SIDE OF BOARD)

PROTECTIVE BONDING CIRCUIT

ELECTRICAL SYMBOLS PER E1537

LINCOLN ELECTRIC

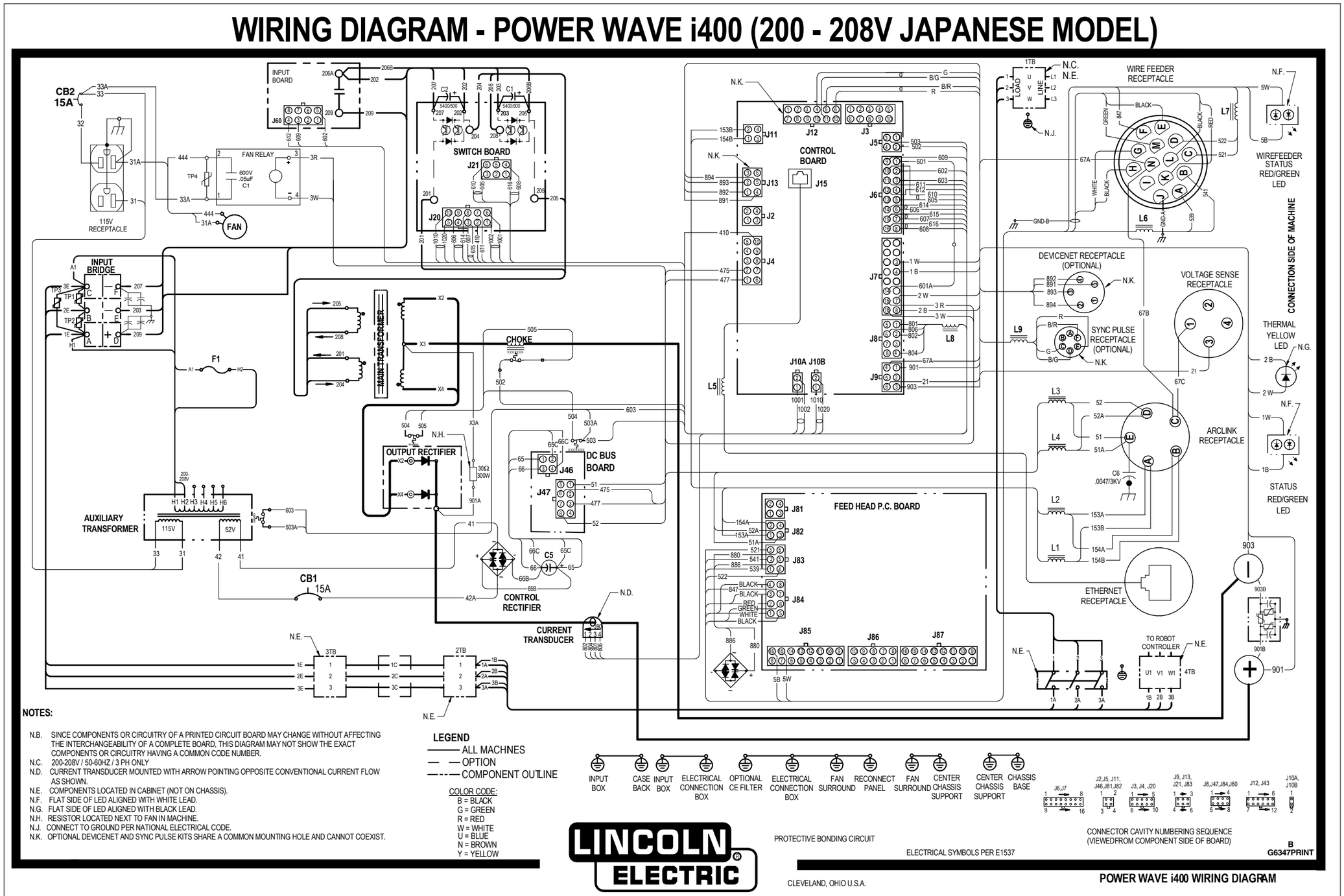
CLEVELAND, OHIO U.S.A.

C G6031PRINT

POWER WAVE i400 WIRING DIAGRAM

NOTE: This diagram is for reference only. It may not be accurate for all machines covered by this manual. The wiring diagram specific to your code is pasted inside one of the enclosure panels of your machine.

WIRING DIAGRAM - POWER WAVE i400 (200 - 208V JAPANESE MODEL)



NOTES:

N.B. SINCE COMPONENTS OR CIRCUITRY OF A PRINTED CIRCUIT BOARD MAY CHANGE WITHOUT AFFECTING THE INTERCHANGEABILITY OF A COMPLETE BOARD, THIS DIAGRAM MAY NOT SHOW THE EXACT COMPONENTS OR CIRCUITRY HAVING A COMMON CODE NUMBER.
N.C. 200-208V / 50-60HZ / 3 PH ONLY.
N.D. CURRENT TRANSDUCER MOUNTED WITH ARROW POINTING OPPOSITE CONVENTIONAL CURRENT FLOW AS SHOWN.
N.E. COMPONENTS LOCATED IN CABINET (NOT ON CHASSIS).
N.F. FLAT SIDE OF LED ALIGNED WITH WHITE LEAD.
N.G. FLAT SIDE OF LED ALIGNED WITH BLACK LEAD.
N.H. RESISTOR LOCATED NEXT TO FAN IN MACHINE.
N.J. CONNECT TO GROUND PER NATIONAL ELECTRICAL CODE.
N.K. OPTIONAL DEVICENET AND SYNC PULSE KITS SHARE A COMMON MOUNTING HOLE AND CANNOT COEXIST.

LEGEND

——— ALL MACHINES
— — OPTION
——-—- COMPONENT OUTLINE

COLOR CODE:
B = BLACK
G = GREEN
R = RED
W = WHITE
U = BLUE
N = BROWN
Y = YELLOW

INPUT BOX | CASE BACK | INPUT BOX | ELECTRICAL CONNECTION BOX | OPTIONAL CE FILTER | ELECTRICAL CONNECTION BOX | FAN SURROUND | RECONNECT PANEL | FAN SURROUND | CENTER CHASSIS SUPPORT | CENTER CHASSIS SUPPORT | CHASSIS BASE

J6,J7 | J2,J5, J11, J46,J81,J82 | J3, J4, J20 | J9, J13, J21, J83 | J8,J47,J84,J60 | J12, J43 | J10A, J10B

CONNECTOR CAVITY NUMBERING SEQUENCE (VIEWEDFROM COMPONENT SIDE OF BOARD)

PROTECTIVE BONDING CIRCUIT

ELECTRICAL SYMBOLS PER E1537

LINCOLN ELECTRIC

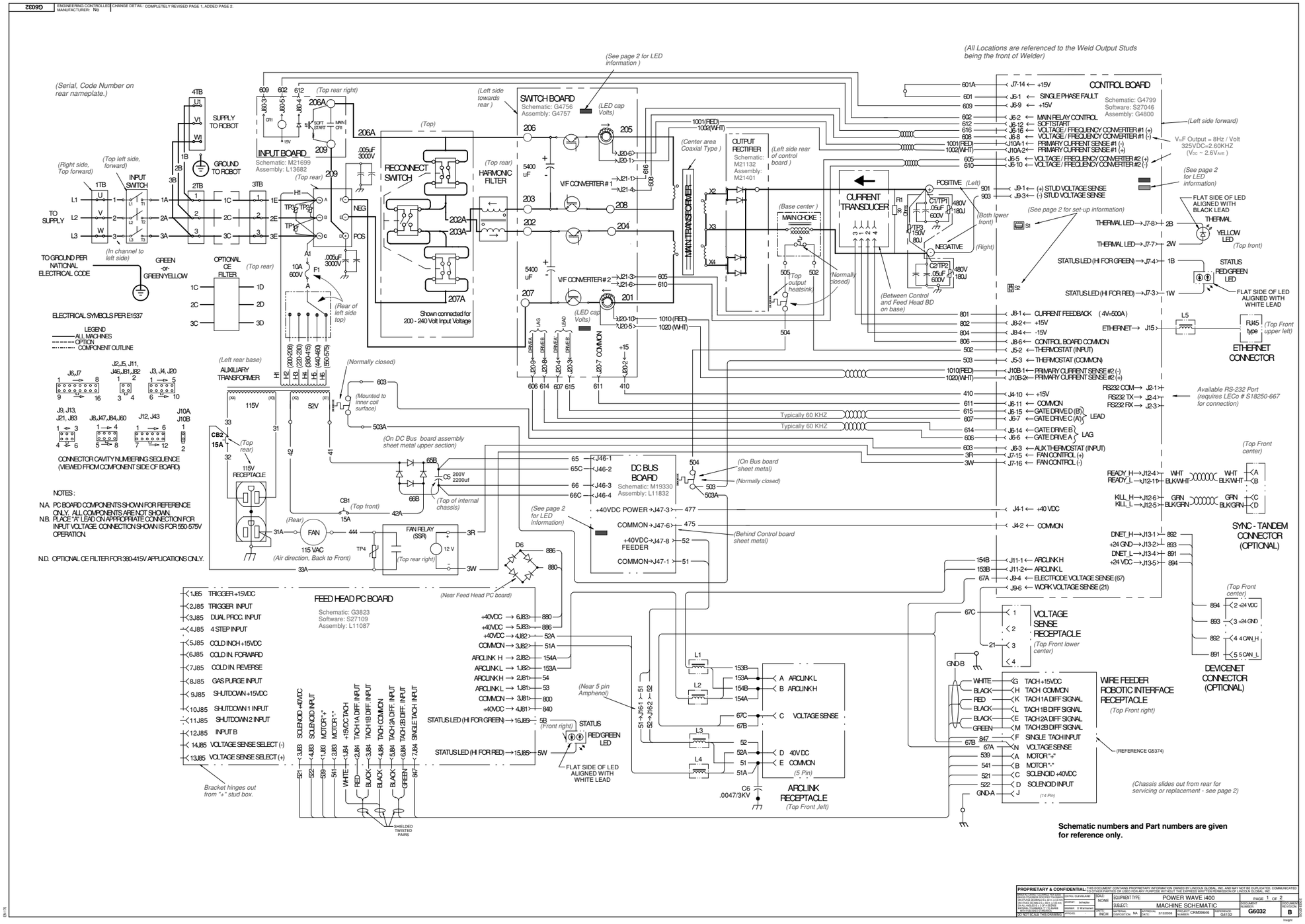
CLEVELAND, OHIO U.S.A.

B
G6347PRINT

POWER WAVE i400 WIRING DIAGRAM

NOTE: This diagram is for reference only. It may not be accurate for all machines covered by this manual. The wiring diagram specific to your code is pasted inside one of the enclosure panels of your machine.

SCHEMATIC - COMPLETE MACHINE - CODES 11454 & 11454R - G6032 (PAGE 1)

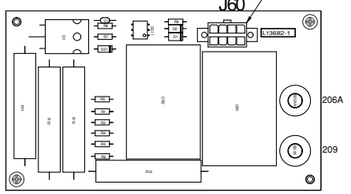


NOTE: This diagram is for reference only. It may not be accurate for all machines covered by this manual.

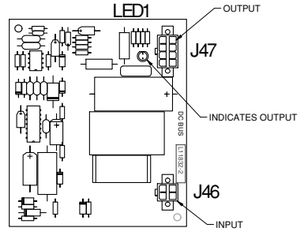
SCHEMATIC - COMPLETE MACHINE - CODES 11454 & 11454R - G6032 (PAGE 2)

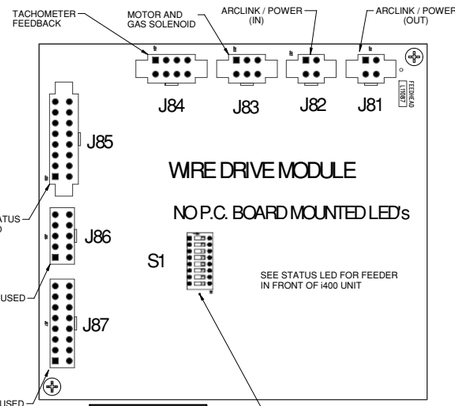
G6032 | ENGINEERING CONTROLLED MANUFACTURER: No | CHANGE DETAIL: COMPLETELY REVISED PAGE 1, ADDED PAGE 2.

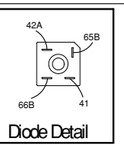
INPUT BOARD



DC BUS BOARD

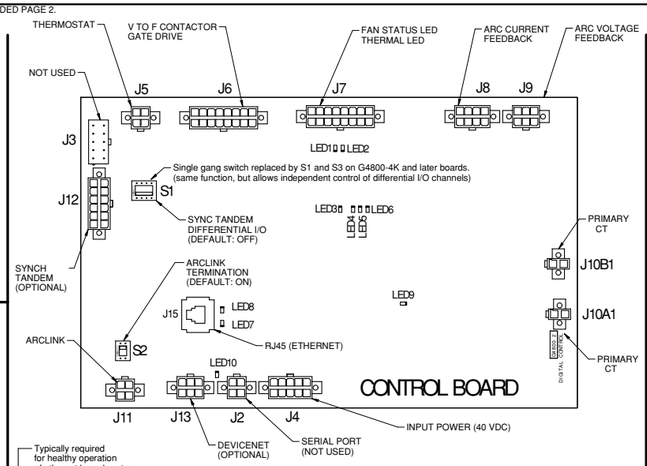






Wire Drive Module Board DIP Switch:

Switch		Description	Comments
1		Object Instance LSB (default - off)	Used for manual ArcLink Configuration. Not acknowledged on the i400 platform.
2		Object Instance MSB (default - off)	
3		Equipment Group 1 Select (default - off)	
4		Equipment Group 2 Select (default - off)	
5		Equipment Group 3 Select (default - off)	
6		Equipment Group 4 Select (default - off)	
7	off	Electrode polarity positive (default)	Used for configuring electrode polarity. Must be off to enable external (teach pendant) configuration.
	on	Electrode polarity negative	
8	off	Low speed gear (default)	Used for configuring wirefeeder gear ratio. Must be off to enable external (teach pendant) configuration.
	on	high speed gear	



Typically required for healthy operation of ethernet based system

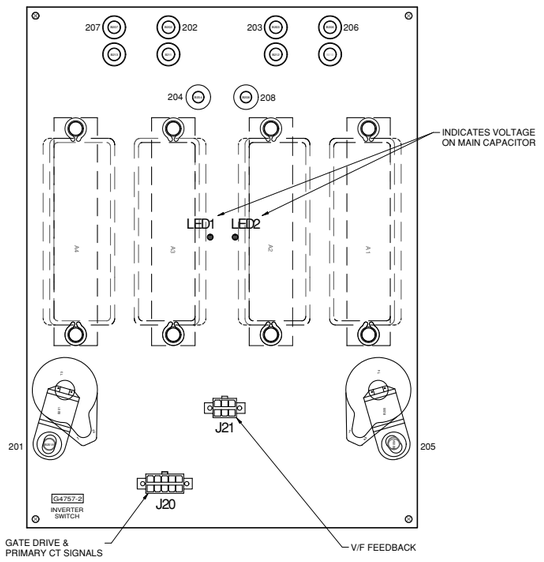
G4800 Digital Control PC Board Status LED's

LED #	COLOR	STATUS	FUNCTION
1	Green	See Table	Board Status Indicators Solid Green indicates OK (See IM or SVM for error codes)
2	Red	See Table	
3	Green	ON	Output Enable True (threshold determined by weld mode)
		OFF	Output Enable False (threshold determined by weld mode)
4	Green	ON	Single Phase Operation Detected (not valid for i400)
		OFF	Three Phase Operation Detected
5	Green	ON	Remote Electrode Voltage Sense Active (67 Lead)
		OFF	Electrode Voltage Sensed from Output Stud
6	Green	ON	Remote Work Voltage Sense Active (21 Lead)
		OFF	Work Voltage Sensed from Output Stud
7	Green	ON	Ethernet Physically connected to network or PC
		FLASH	Ethernet Physically connected and communicating
		OFF	No Ethernet Connection
8	Green	ON	Ethernet Speed = 100 Mb (default)
		OFF	Ethernet Speed = 10 Mb
9	Green	ON	On Board Power Supply Active (derived from 40V bus)
		OFF	On Board Power Supply Inactive
10	Green	ON	External DeviceNet Supply Connected
		OFF	External DeviceNet Supply Connected

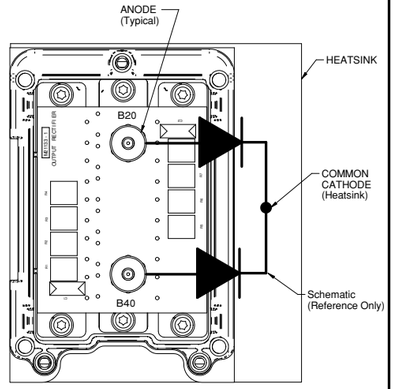
ArcLink Status LED's

GREEN	RED	INDICATION
OFF	OFF	Offline: Check power, or configuration
ON	OFF	Online and operational
FLASH	OFF	System Mapping
RAPID FLASH	OFF	Mapping error or Machine identified by PC
*OFF	FLASH	Non-recoverable system fault: • Error code numbers flash red with long pause between digits • Green flash between codes

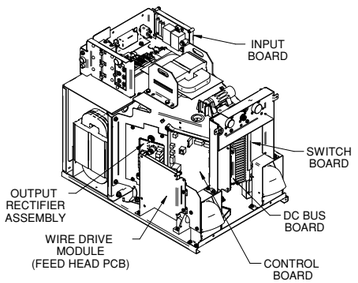
SWITCH PC BOARD



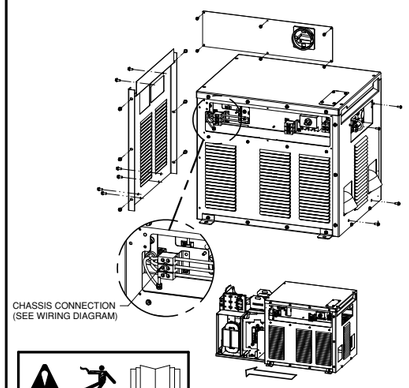
OUTPUT RECTIFIER ASSEMBLY



COMPONENT LOCATION DETAIL



CHASSIS REMOVAL DETAIL



Troubleshooting the Power Wave i400

Using the Status LED

LIGHT CONDITION	MEANING
Steady Green	System OK. Power source is operational, and is communicating normally with all healthy peripheral equipment connected to its ArcLink network.
Blinking Green	Occurs during power up or a system reset, and indicates the Power Wave i400 is mapping (identifying) each component in the system. Normal for first 1-10 seconds after power is turned on, or if the system configuration is changed during operation.
Fast Blinking Green	Under normal conditions indicates Auto-mapping has failed. Also used by the ***Diagnostics Utility*** (included on the ***Power Wave Utilities*** and ***Service Navigator*** *CD's or available at* ***www.powerwavesoftware.com***) to identify the selected machine when connecting to a specific IP address.
Alternating Green and Red	Non-recoverable system fault. If the Status lights are flashing any combination of red and green, errors are present. Read the error code(s) before the machine is turned off. Error Code interpretation through the Status light is detailed in the Service Manual. Individual code digits are flashed in red with a long pause between digits. If more than one code is present, the codes will be separated by a green light. Only active error conditions will be accessible through the Status Light. Error codes can also be retrieved with the ***Diagnostics Utility*** (included on the ***Power Wave Utilities*** and ***Service Navigator*** *CD's or available at* ***www.powerwavesoftware.com***). This is the preferred method, since it can access historical information contained in the error log. To clear the active error(s), turn power source off, and back on to reset.
Steady Red	Not applicable.
Blinking Red	Not applicable.

Error codes for the Power Wave i400

Power Source – Weld Controller		
Error Code #	LECO (Fanuc #)	Indication
31 Primary (Input) overcurrent error.	49	Excessive Primary current present. May be related to a switch board or output rectifier failure.
32 Capacitor "A" under voltage (right side facing the Switch PCB)	50	Low voltage on the main capacitors. May be caused by improper input configuration, or an open/short circuit in the primary side of the machine.
33 Capacitor "B" under voltage (left side facing the Switch PCB)	51	
34 Capacitor "A" over voltage (right side facing the Switch PCB)	52	Excess voltage on the main capacitors. May be caused by improper input configuration, , excessive line voltage, or improper capacitor balance (see Error 43)
35 Capacitor "B" over voltage (left side facing the Switch PCB)	53	
36 Thermal error	54	Indicates over temperature. Usually accompanied by Thermal LED. Check fan operation. Be sure process does not exceed duty cycle limit of the machine.
37 Softstart (pre-charge) error	55	Capacitor pre-charge failed. Usually accompanied by codes 32 and 33.
39 Misc. hardware fault	57	Unknown glitch has occurred on the fault interrupt circuitry. Sometimes caused by primary over current fault, or intermittent connections in the thermostat circuit.
43 Capacitor delta error	67	The maximum voltage difference between the main capacitors has been exceeded. May be accompanied by errors 32-35. May be caused by an open or short in the primary or secondary circuit(s).
54 Secondary (output) over current	84	The long term average secondary (weld) current limit has been exceeded. This error will immediately turn off the machine output. NOTE: The long term average secondary current limit is 450 amps.
Other	see complete listing	A complete list of error codes is available in the ***Diagnostics Utility*** (included on the ***Power Wave Utilities*** and ***Service Navigator*** *CD's or available at* ***www.powerwavesoftware.com***). Error codes that contain three or four digits are defined as fatal errors. These codes generally indicate internal errors on the Power Source Control Board. If cycling the input power on the machine does not clear the error, contact the Service Department.

Wire Drive Module		
Error Code #	LECO (Fanuc #)	Indication
81 Motor Overload	129	Long term average motor current limit has been exceeded. Typically indicates mechanical overload of system. If problem continues consider higher torque gear ratio (lower speed range).
82 Motor Overcurrent	130	Absolute maximum motor current level has been exceeded. This is a short term average to protect drive circuitry.
83 Shutdown #1	131	The Shutdown inputs on the Power Wave i400 have been disabled. The presence of these errors indicates the Feed Head Control PCB may contain the wrong operating software.
84 Shutdown #2	132	

EM170

MANUFACTURING TOLERANCE PER SSDM UNLESS OTHERWISE SPECIFIED TO TOLERANCE ON 2 PLACE DECIMALS IS ± .02 in. (± 0.5 mm) ON 3 PLACE DECIMALS IS ± .005 in. (± 0.05 mm) ON ALL ANGLES IS ± 5 OF A DEGREE MATERIAL TOLERANCE (+) TO AGREE WITH PUBLISHED STANDARDS.
DO NOT SCALE THIS DRAWING

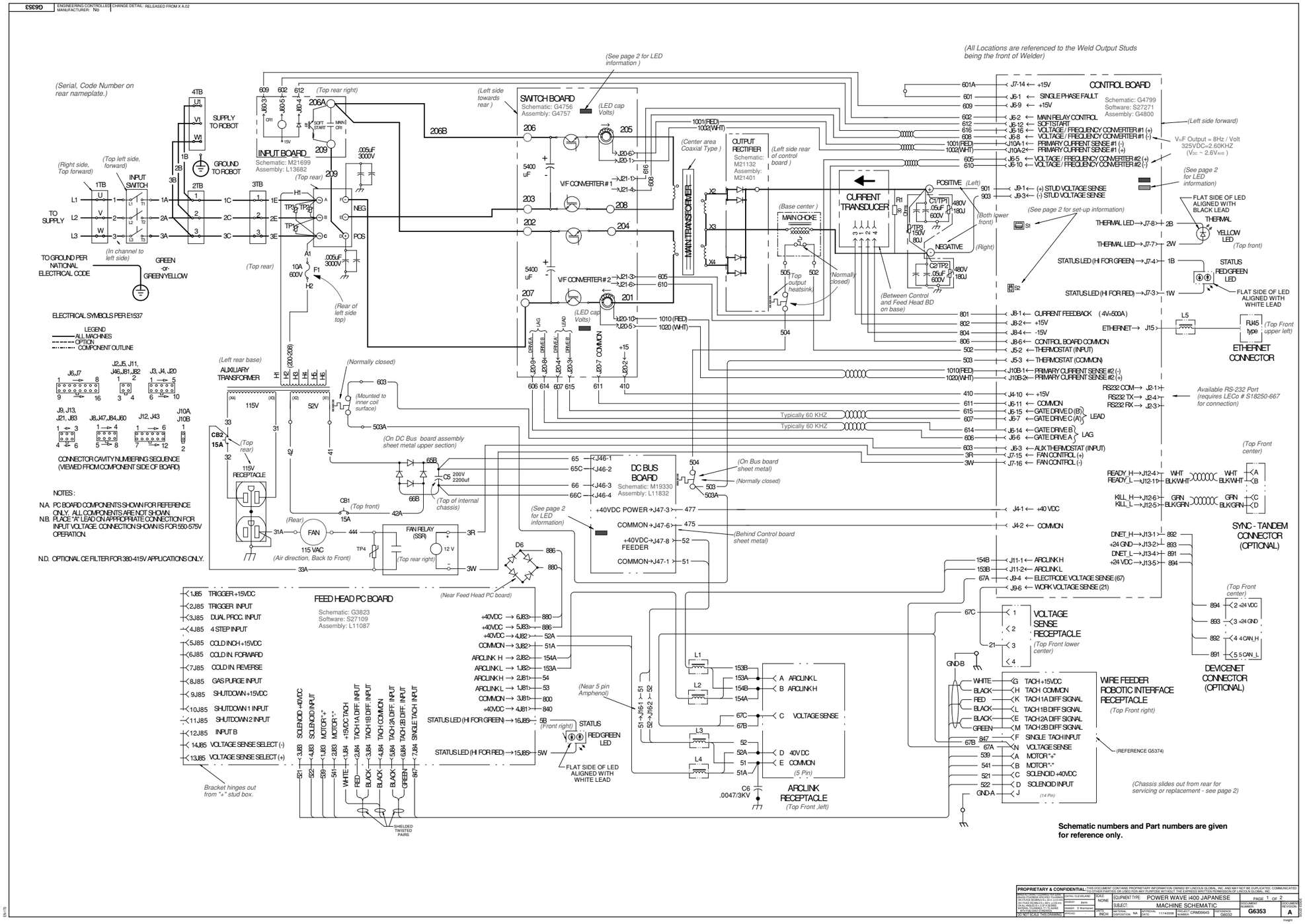
CONTROL: CLEVELAND | SCALE: NONE if PRINTED @ A1 SIZE | UNITS: INCH
DRAWN BY: bsheplav | ENGINEER: D Wanhainen | APPROVED: -
MATERIAL DISPOSITION: NA | APPROVAL DATE: 2/12/2008

EQUIPMENT TYPE: POWER WAVE i400
SUBJECT: MACHINE SCHEMATIC
PROJECT NUMBER: CRM39646 | REFERENCE: G4132
PAGE 2 OF 2
DOCUMENT NUMBER: G6032 | DOCUMENT REVISION: B
SOLID EDGE Insight

NOTE: This diagram is for reference only. It may not be accurate for all machines covered by this manual.

Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC

SCHEMATIC - COMPLETE MACHINE - CODES 11536 & 11536R - G6353 (PAGE 1)

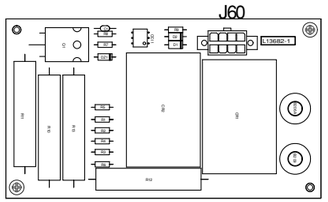


NOTE: This diagram is for reference only. It may not be accurate for all machines covered by this manual.

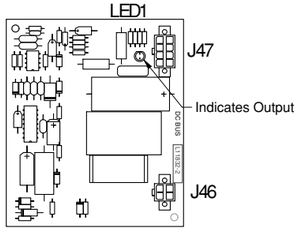
SCHEMATIC - COMPLETE MACHINE - CODES 11536 & 11536R - G6353 (PAGE 2)

G6353 | ENGINEERING CONTROLLED | CHANGE DETAIL: RELEASED FROM X A.02
MANUFACTURER: No

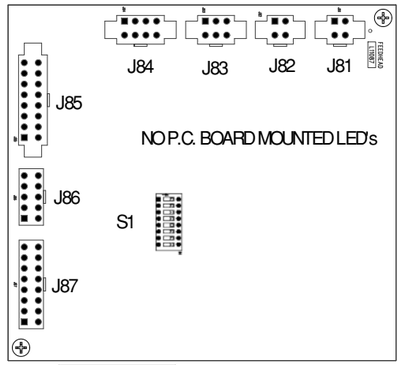
INPUT BOARD

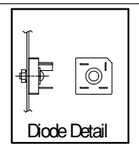


DC BUS BOARD



WIRE DRIVE MODULE

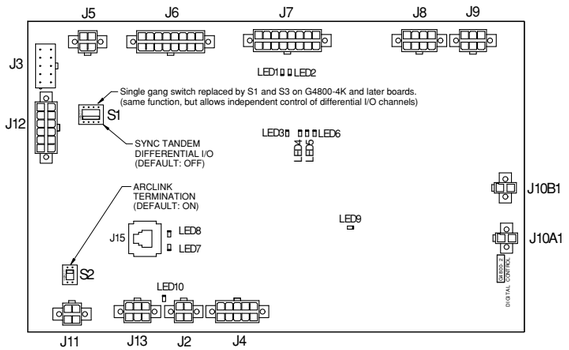




Feed Head Board DIP Switch:

Switch		Description	Comments
1		Object Instance LSB (default - off)	Used for manual ArcLink Configuration. Not acknowledged on the i400 platform.
2		Object Instance MSB (default - off)	
3		Equipment Group 1 Select (default - off)	
4		Equipment Group 2 Select (default - off)	
5		Equipment Group 3 Select (default - off)	
6		Equipment Group 4 Select (default - off)	
7	off	Electrode polarity positive (default)	Used for configuring electrode polarity. Must be off to enable external (teach pendant) configuration.
	on	Electrode polarity negative	
8	off	Low speed gear (default)	Used for configuring wirefeeder gear ratio. Must be off to enable external (teach pendant) configuration.
	on	high speed gear	

CONTROL BOARD



Typically required for healthy operation of ethernet based system

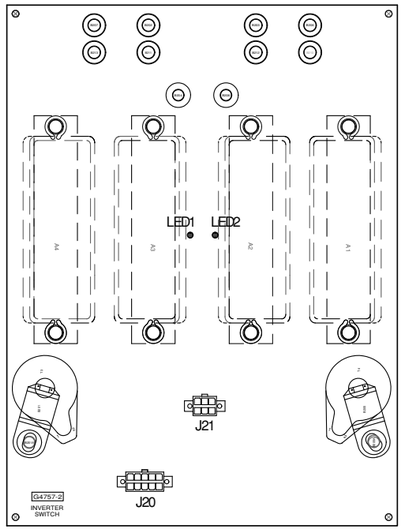
G4800 Digital Control PC Board Status LED's

LED #	COLOR	STATUS	FUNCTION
1	Green	See Table	Board Status Indicators Solid Green indicates OK (See IM or SVM for error codes)
2	Red	See Table	
3	Green	ON	Output Enable True (threshold determined by weld mode)
		OFF	Output Enable False (threshold determined by weld mode)
4	Green	ON	Single Phase Operation Detected (not valid for i400)
		OFF	Three Phase Operation Detected
5	Green	ON	Remote Electrode Voltage Sense Active (67 Lead)
		OFF	Electrode Voltage Sensed from Output Stud
6	Green	ON	Remote Work Voltage Sense Active (21 Lead)
		OFF	Work Voltage Sensed from Output Stud
7	Green	FLASH	Ethernet Physically connected and communicating
		OFF	No Ethernet Connection
8	Green	ON	Ethernet Speed = 100 Mb (default)
		OFF	Ethernet Speed = 10 Mb
9	Green	ON	On Board Power Supply Active (derived from 40V bus)
		OFF	On Board Power Supply Inactive
10	Green	ON	External DeviceNet Supply Connected
		OFF	External DeviceNet Supply Connected

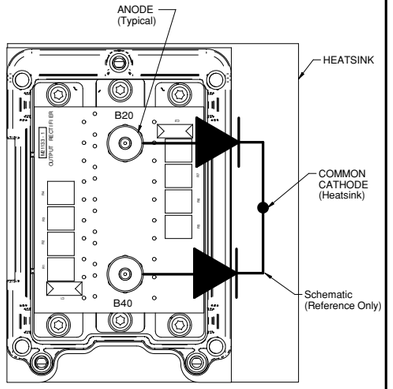
ArcLink Status LED's

GREEN	RED	INDICATION
OFF	OFF	Offline. Check power, or configuration
ON	OFF	Online and operational
FLASH	OFF	System Mapping
RAPID FLASH	OFF	Mapping error or Machine identified by PC
*OFF	FLASH	Non-recoverable system fault: • Error code numbers flash red with long pause between digits • Green flash between codes

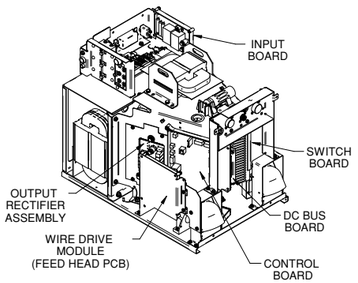
SWITCHBOARD PC BOARD



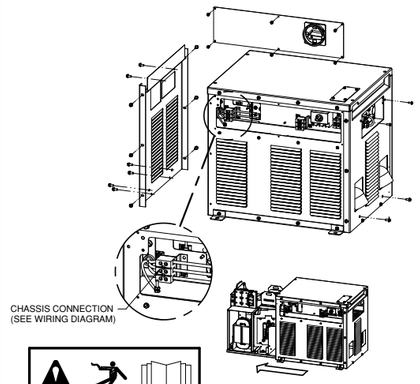
OUTPUT RECTIFIER ASSEMBLY



COMPONENT LOCATION DETAIL



CHASSIS REMOVAL DETAIL



Troubleshooting the Power Wave i400

Using the Status LED

LIGHT CONDITION	MEANING
Steady Green	System OK. Power source is operational, and is communicating normally with all healthy peripheral equipment connected to its ArcLink network.
Blinking Green	Occurs during power up or a system reset, and indicates the Power Wave i400 is mapping (identifying) each component in the system. Normal for first 1-10 seconds after power is turned on, or if the system configuration is changed during operation.
Fast Blinking Green	Under normal conditions indicates Auto-mapping has failed. Also used by the ***Diagnostics Utility*** (included on the ***Power Wave Utilities*** and ***Service Navigator*** *CD's or available at* ***www.powerwavesoftware.com***) to identify the selected machine when connecting to a specific IP address.
Alternating Green and Red	Non-recoverable system fault. If the Status lights are flashing any combination of red and green, errors are present. Read the error code(s) before the machine is turned off. Error Code interpretation through the Status light is detailed in the Service Manual. Individual code digits are flashed in red with a long pause between digits. If more than one code is present, the codes will be separated by a green light. Only active error conditions will be accessible through the Status Light. Error codes can also be retrieved with the ***Diagnostics Utility*** (included on the ***Power Wave Utilities*** and ***Service Navigator*** *CD's or available at* ***www.powerwavesoftware.com***). This is the preferred method, since it can access historical information contained in the error log. To clear the active error(s), turn power source off, and back on to reset.
Steady Red	Not applicable.
Blinking Red	Not applicable.

Error codes for the Power Wave i400

Power Source – Weld Controller

Error Code #	LECO (Fanuc #)	Indication
31 Primary (Input) overcurrent error.	49	Excessive Primary current present. May be related to a switch board or output rectifier failure.
32 Capacitor "A" under voltage (left side facing the Switch PCB)	50	Low voltage on the main capacitors. May be caused by improper input configuration, or an open/short circuit in the primary side of the machine.
33 Capacitor "B" under voltage (left side facing the Switch PCB)	51	
34 Capacitor "A" over voltage (right side facing the Switch PCB)	52	Excess voltage on the main capacitors. May be caused by improper input configuration, , excessive line voltage, or improper capacitor balance (see Error 43)
35 Capacitor "B" over voltage (left side facing the Switch PCB)	53	
36 Thermal error	54	Indicates over temperature. Usually accompanied by Thermal LED. Check fan operation. Be sure process does not exceed duty cycle limit of the machine.
37 Softstart (pre-charge) error	55	Capacitor pre-charge failed. Usually accompanied by codes 32 and 33.
39 Misc. hardware fault	57	Unknown glitch has occurred on the fault interrupt circuitry. Sometimes caused by primary over current fault, or intermittent connections in the thermostat circuit.
43 Capacitor delta error	67	The maximum voltage difference between the main capacitors has been exceeded. May be accompanied by errors 32-35. May be caused by an open or short in the primary or secondary circuit(s).
54 Secondary (output) over current	84	The long term average secondary (weld) current limit has been exceeded. This error will immediately turn off the machine output. NOTE: The long term average secondary current limit is 450 amps.
Other	see complete listing	A complete list of error codes is available in the ***Diagnostics Utility*** (included on the ***Power Wave Utilities*** and ***Service Navigator*** *CD's or available at* ***www.powerwavesoftware.com***). Error codes that contain three or four digits are defined as fatal errors. These codes generally indicate internal errors on the Power Source Control Board. If cycling the input power on the machine does not clear the error, contact the Service Department.

Wire Drive Module

Error Code #	LECO (Fanuc #)	Indication
81 Motor Overload	129	Long term average motor current limit has been exceeded. Typically indicates mechanical overload of system. If problem continues consider higher torque gear ratio (lower speed range).
82 Motor Overcurrent	130	Absolute maximum motor current level has been exceeded. This is a short term average to protect drive circuitry.
83 Shutdown #1	131	The Shutdown inputs on the Power Wave i400 have been disabled. The presence of these errors indicates the Feed Head Control PCB may contain the wrong operating software.
84 Shutdown #2	132	

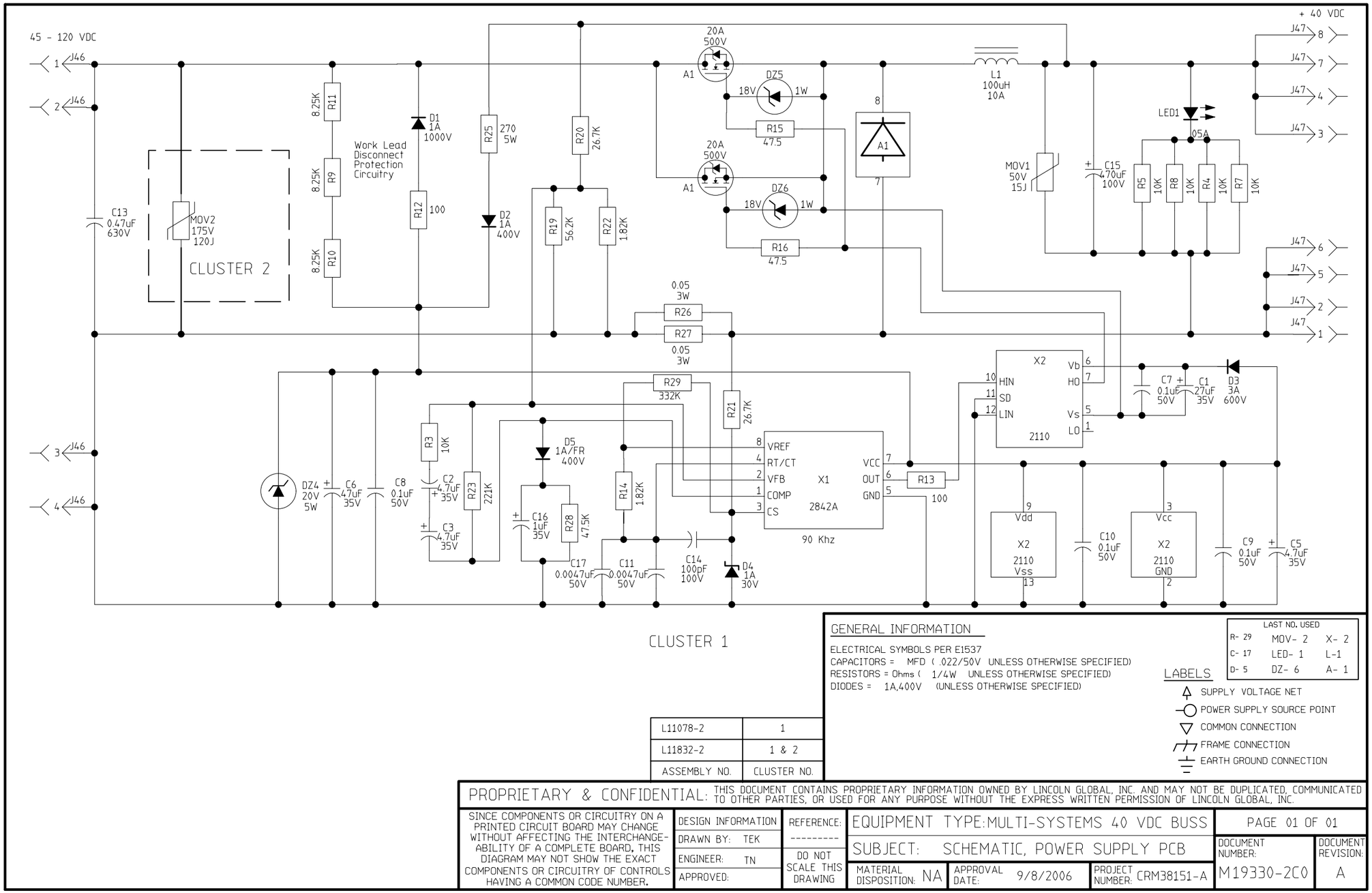
MANUFACTURING TOLERANCE PER SSDM UNLESS OTHERWISE SPECIFIED TO TOLERANCE ON 2 PLACE DECIMALS IS ± .02 in. (± 0.5 mm) ON 3 PLACE DECIMALS IS ± .002 in. (± 0.05 mm) ON ALL ANGLES IS ± .5 OF A DEGREE MATERIAL TOLERANCE (+) TO AGREE WITH PUBLISHED STANDARDS.
DO NOT SCALE THIS DRAWING
CONTROL: CLEVELAND
DRAWN BY: jbarto
ENGINEER: D Wanhainen
APPROVED: -
SCALE: NONE IF PRINTED @ A1 SIZE
UNITS: INCH
EQUIPMENT TYPE: POWER WAVE i400 JAPANESE
SUBJECT: MACHINE SCHEMATIC
MATERIAL DISPOSITION: NA
APPROVAL DATE: 11/14/2008
PROJECT NUMBER: CRM39645
REFERENCE: G6032
PAGE 2 OF 2
DOCUMENT NUMBER: G6353
DOCUMENT REVISION: A
SOLID EDGE Insight

EM170

NOTE: This diagram is for reference only. It may not be accurate for all machines covered by this manual.

Return to Section TOC
Return to Master TOC

SCHEMATIC 40VDC BUS PC BOARD - M19330-2



L11078-2	1
L11832-2	1 & 2
ASSEMBLY NO.	CLUSTER NO.

GENERAL INFORMATION

ELECTRICAL SYMBOLS PER E1537
CAPACITORS = MFD (.022/50V UNLESS OTHERWISE SPECIFIED)
RESISTORS = Ohms (1/4W UNLESS OTHERWISE SPECIFIED)
DIODES = 1A,400V (UNLESS OTHERWISE SPECIFIED)

LAST NO. USED		
R- 29	MOV- 2	X- 2
C- 17	LED- 1	L-1
D- 5	DZ- 6	A- 1

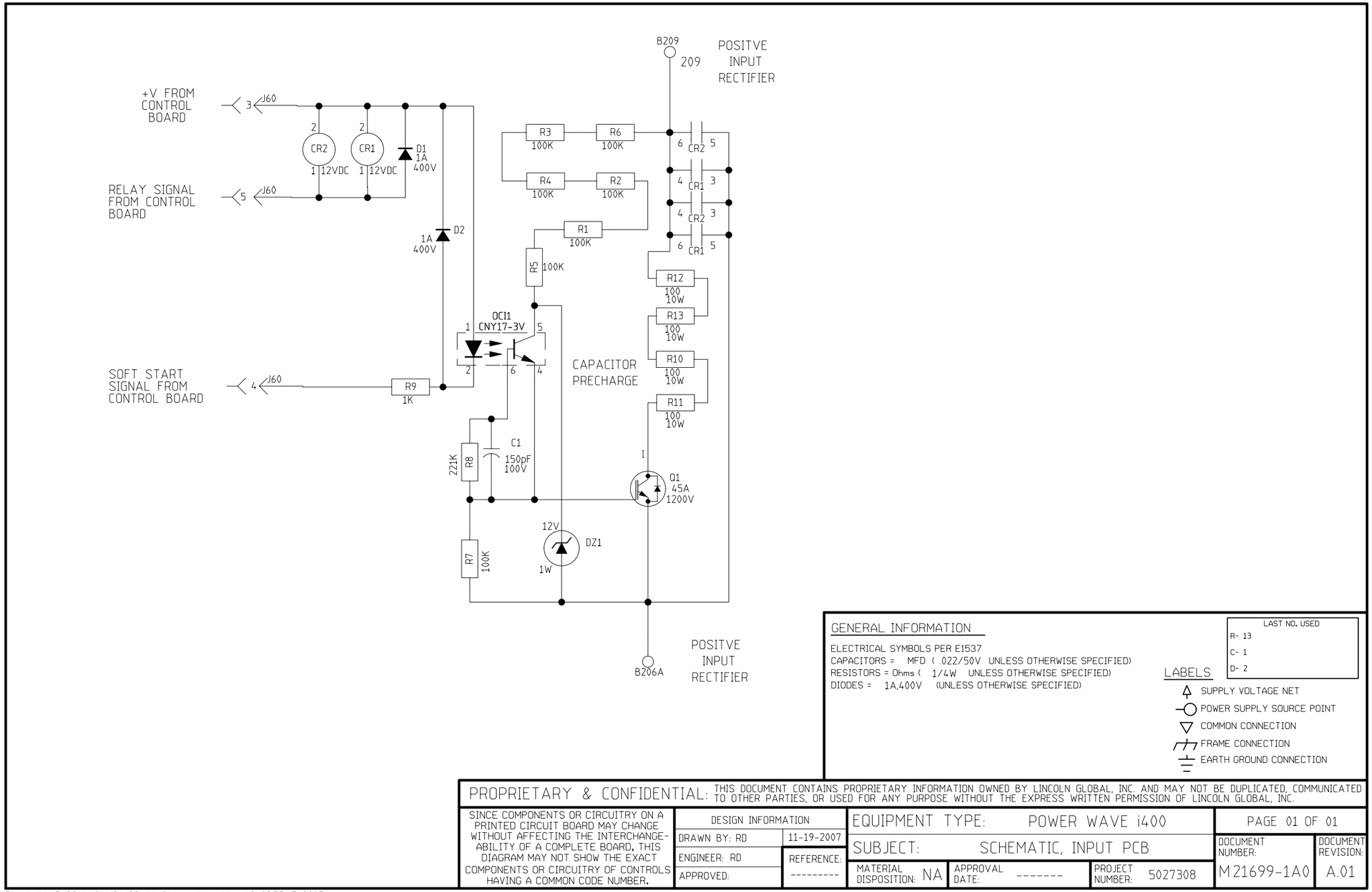
LABELS
- SUPPLY VOLTAGE NET
- POWER SUPPLY SOURCE POINT
- COMMON CONNECTION
- FRAME CONNECTION
- EARTH GROUND CONNECTION

SINCE COMPONENTS OR CIRCUITRY ON A PRINTED CIRCUIT BOARD MAY CHANGE WITHOUT AFFECTING THE INTERCHANGE-ABILITY OF A COMPLETE BOARD, THIS DIAGRAM MAY NOT SHOW THE EXACT COMPONENTS OR CIRCUITRY OF CONTROLS HAVING A COMMON CODE NUMBER.

DESIGN INFORMATION	REFERENCE:	EQUIPMENT TYPE: MULTI-SYSTEMS 40 VDC BUSS			PAGE 01 OF 01	
DRAWN BY: TEK	--------	SUBJECT: SCHEMATIC, POWER SUPPLY PCB			DOCUMENT NUMBER:	DOCUMENT REVISION:
ENGINEER: TN	DO NOT SCALE THIS DRAWING	MATERIAL DISPOSITION: NA	APPROVAL DATE: 9/8/2006	PROJECT NUMBER: CRM38151-A	M19330-2C0	A
APPROVED:						

NOTE: This diagram is for reference only. It may not be accurate for all machines covered by this manual.

SCHEMATIC - INPUT PB BOARD - M21699-1



GENERAL INFORMATION

ELECTRICAL SYMBOLS PER E1537
CAPACITORS = MFD (.022/50V UNLESS OTHERWISE SPECIFIED)
RESISTORS = Ohms (1/4W UNLESS OTHERWISE SPECIFIED)
DIODES = 1A,400V (UNLESS OTHERWISE SPECIFIED)

LAST NO. USED
R- 13
C- 1
D- 2

LABELS
- SUPPLY VOLTAGE NET
- POWER SUPPLY SOURCE POINT
- COMMON CONNECTION
- FRAME CONNECTION
- EARTH GROUND CONNECTION

SINCE COMPONENTS OR CIRCUITRY ON A PRINTED CIRCUIT BOARD MAY CHANGE WITHOUT AFFECTING THE INTERCHANGE-ABILITY OF A COMPLETE BOARD, THIS DIAGRAM MAY NOT SHOW THE EXACT COMPONENTS OR CIRCUITRY OF CONTROLS HAVING A COMMON CODE NUMBER.

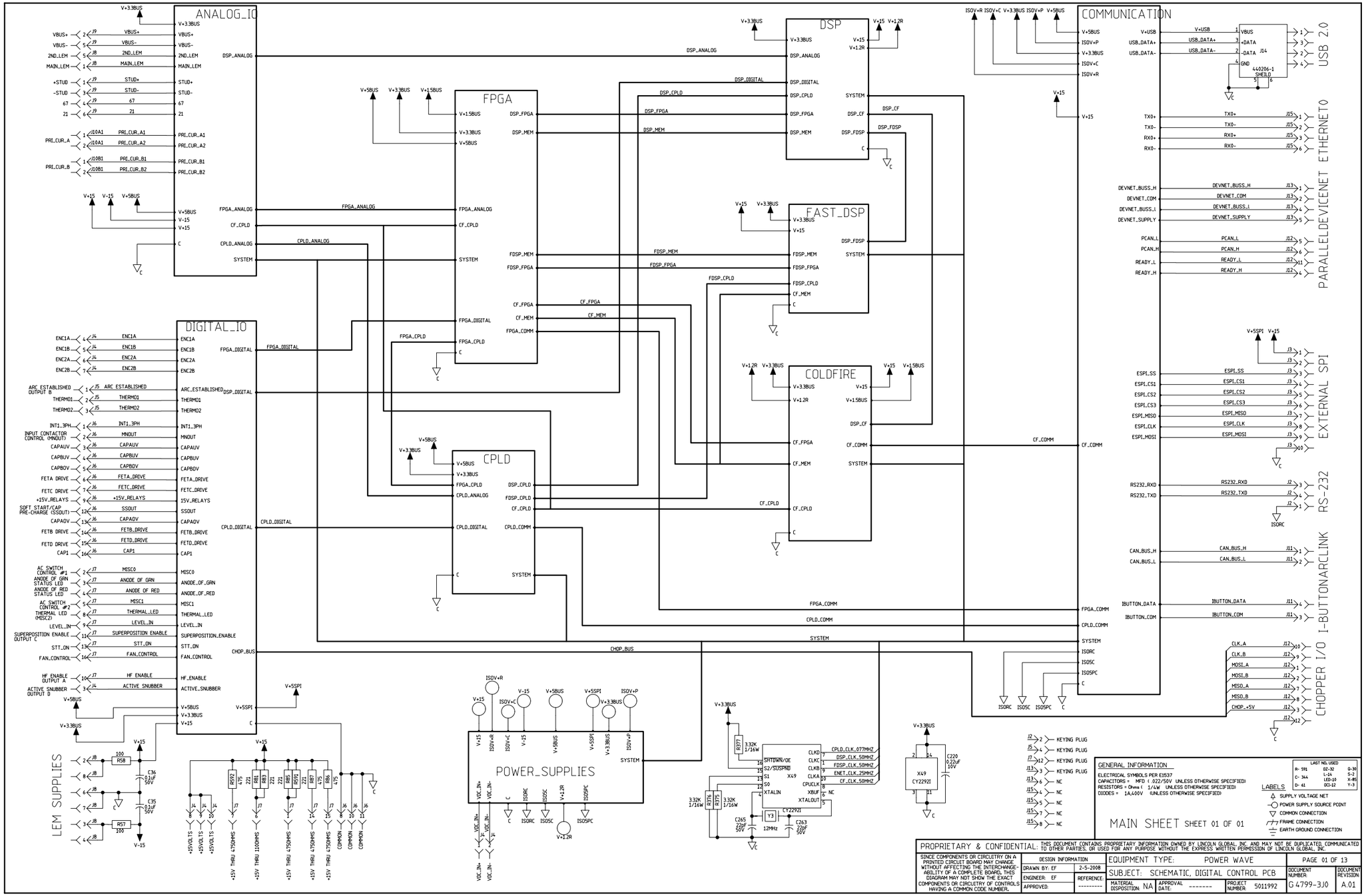
DESIGN INFORMATION			
DRAWN BY: RD	11-19-2007	EQUIPMENT TYPE: POWER WAVE i400	PAGE 01 OF 01
ENGINEER: RD	REFERENCE: ---------	SUBJECT: SCHEMATIC, INPUT PCB	DOCUMENT NUMBER: M21699-1A0 / DOCUMENT REVISION: A.01
APPROVED:		MATERIAL DISPOSITION: NA / APPROVAL DATE: ------- / PROJECT NUMBER: 5027308	

C:\Jobs\L13682-1A0\M21699.sbk(01;) Mon Nov 19 08:33:15 2007

NOTE: This diagram is for reference only. It may not be accurate for all machines covered by this manual.

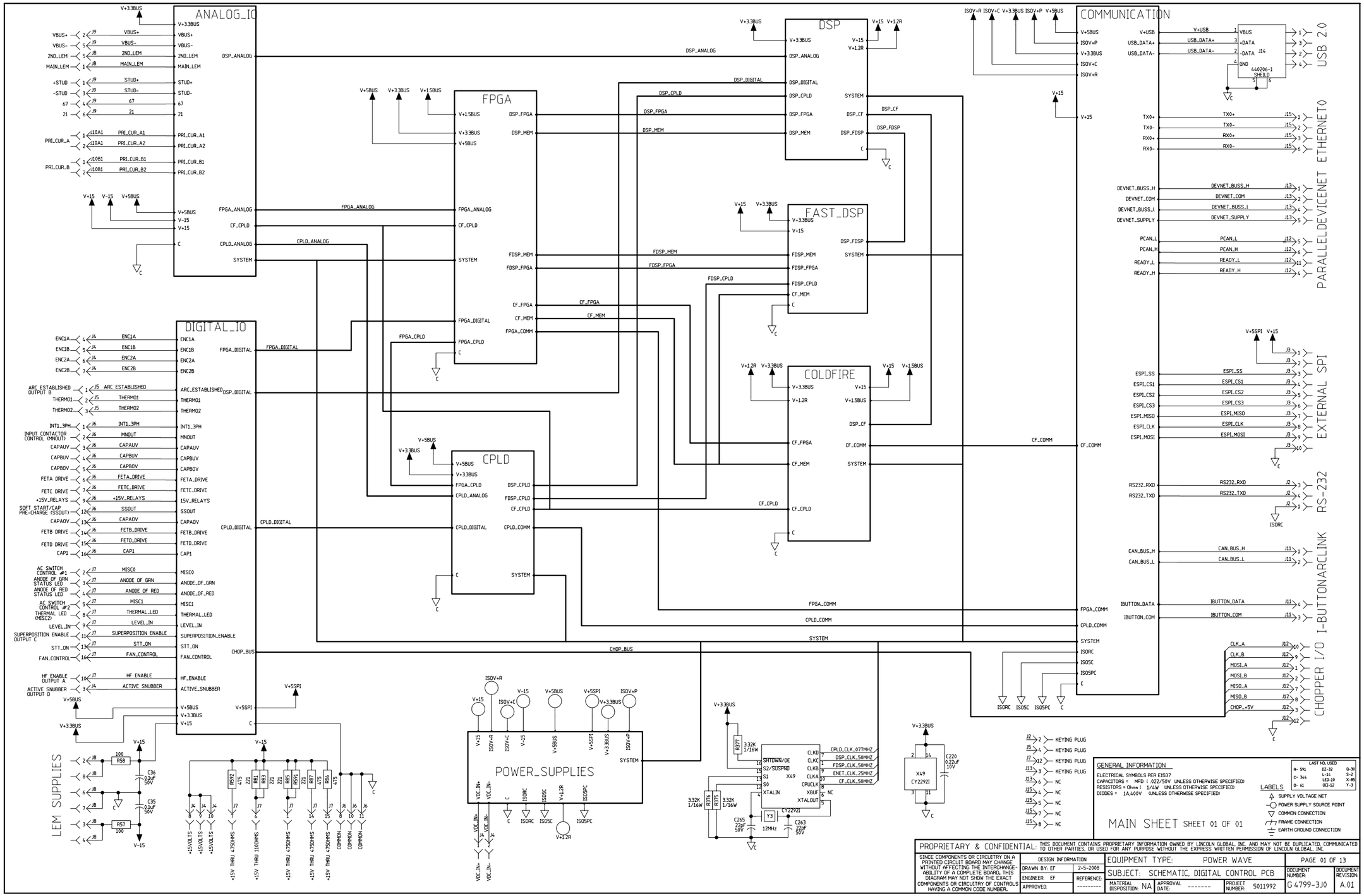
Return to Section TOC
Return to Master TOC

SCHEMATIC - CONTROL PC BOARD - G4799-3 (PAGE 1)



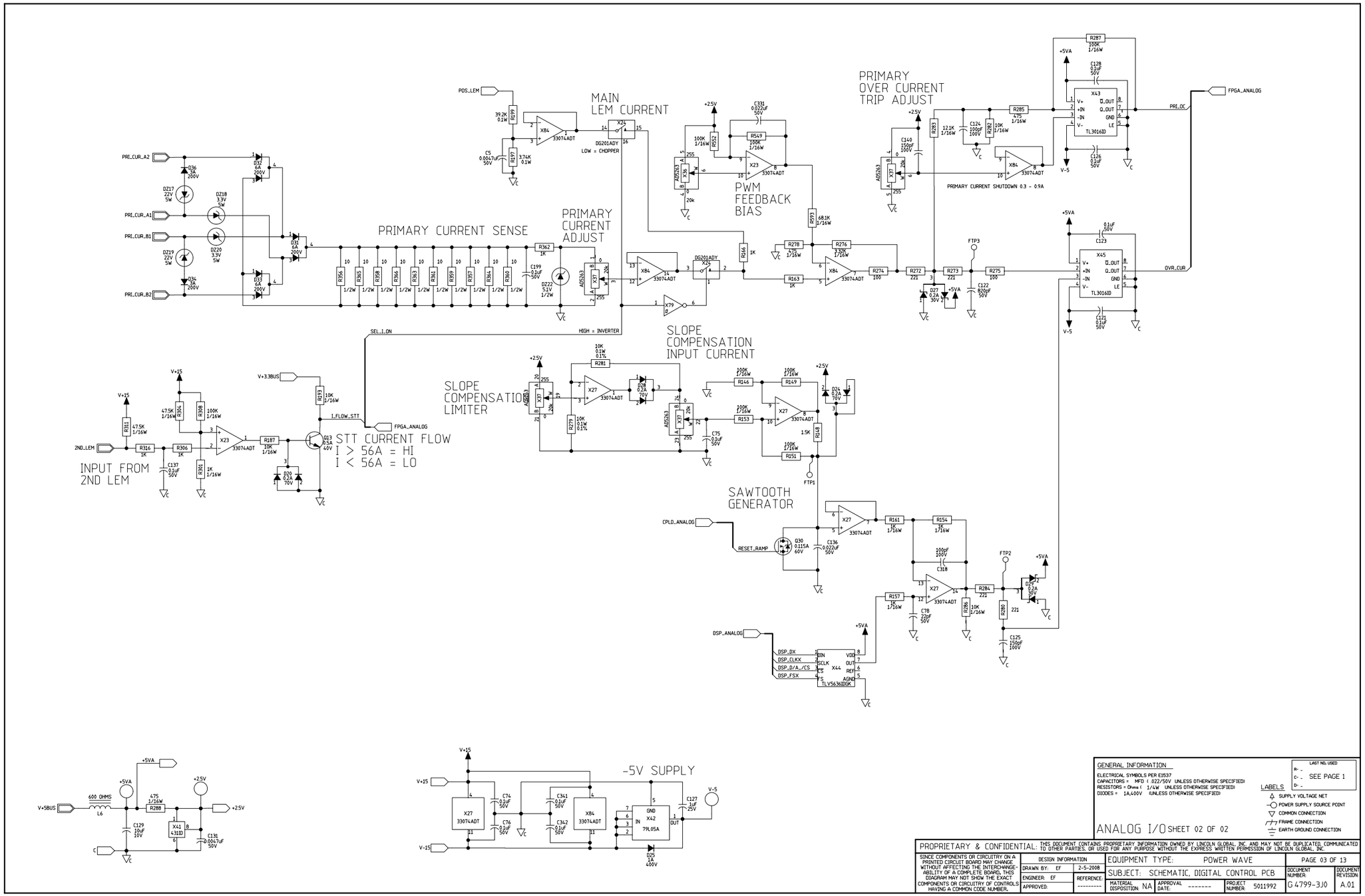
NOTE: This diagram is for reference only. It may not be accurate for all machines covered by this manual.

SCHEMATIC - CONTROL PC BOARD - G4799-3 (PAGE-2)



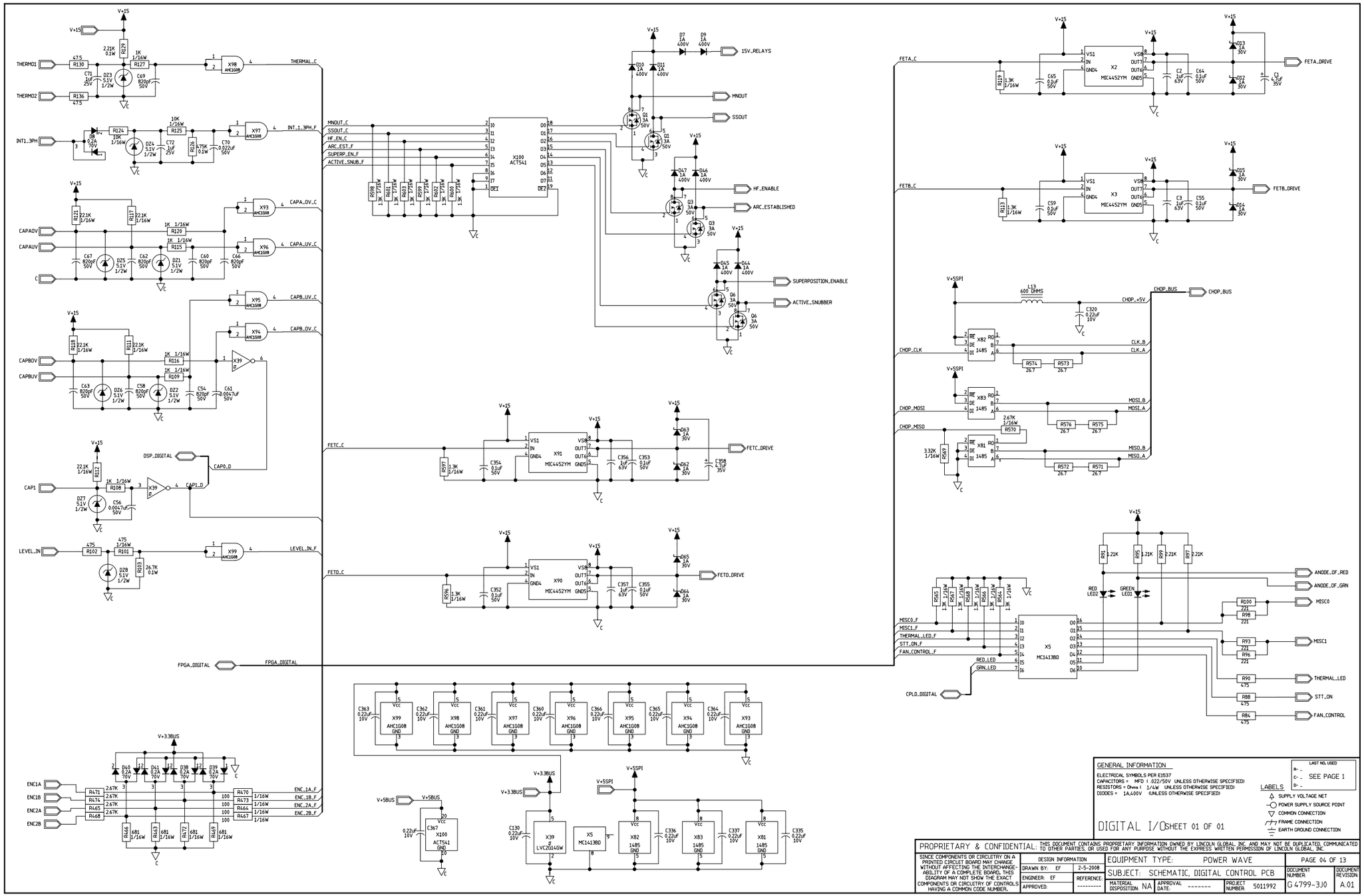
NOTE: This diagram is for reference only. It may not be accurate for all machines covered by this manual.

SCHEMATIC - CONTROL PC BOARD - G4799-3 (PAGE 3)



NOTE: This diagram is for reference only. It may not be accurate for all machines covered by this manual.

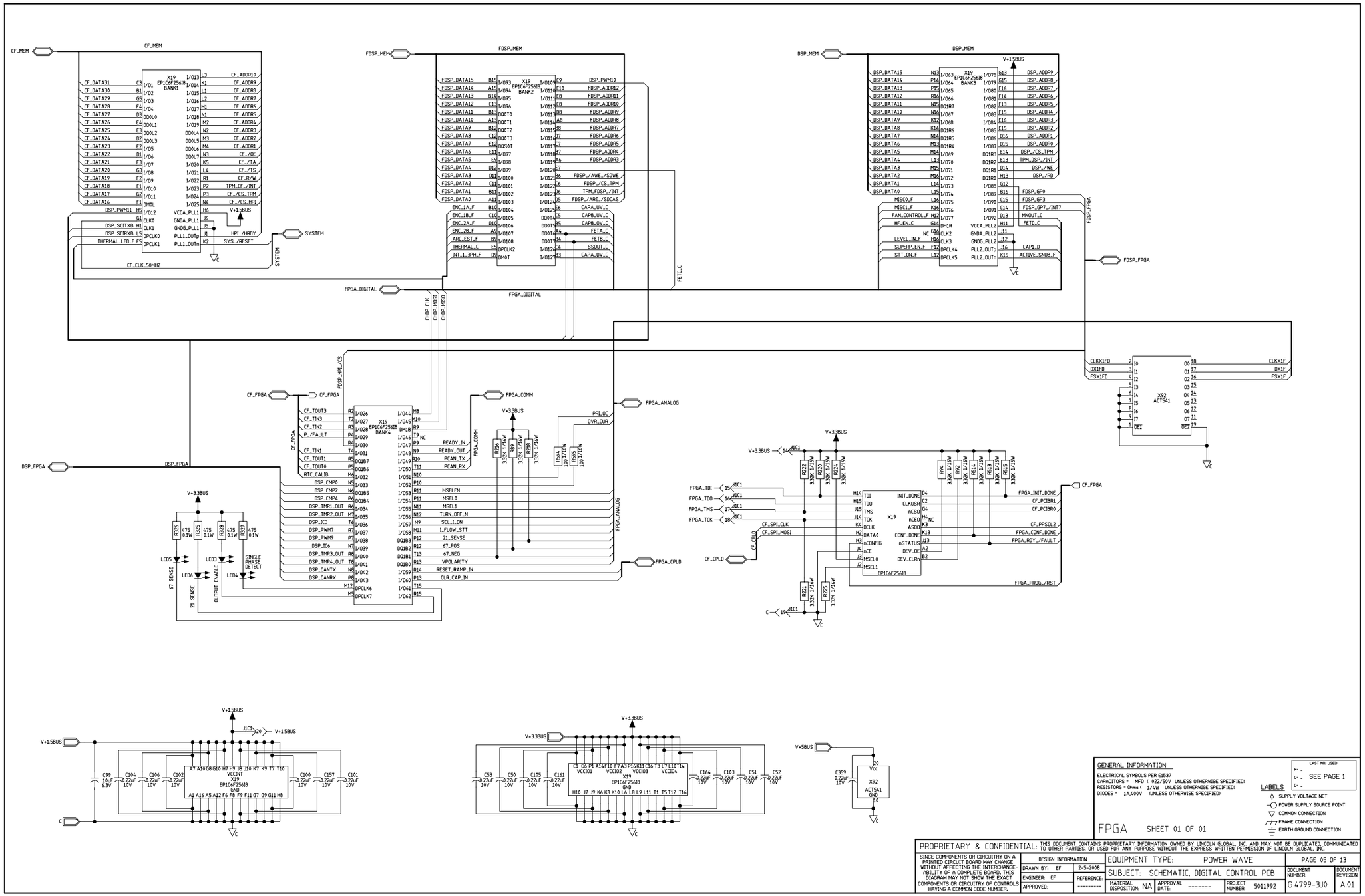
SCHEMATIC - CONTROL PC BOARD - G4799-3 (PAGE 4)



NOTE: This diagram is for reference only. It may not be accurate for all machines covered by this manual.

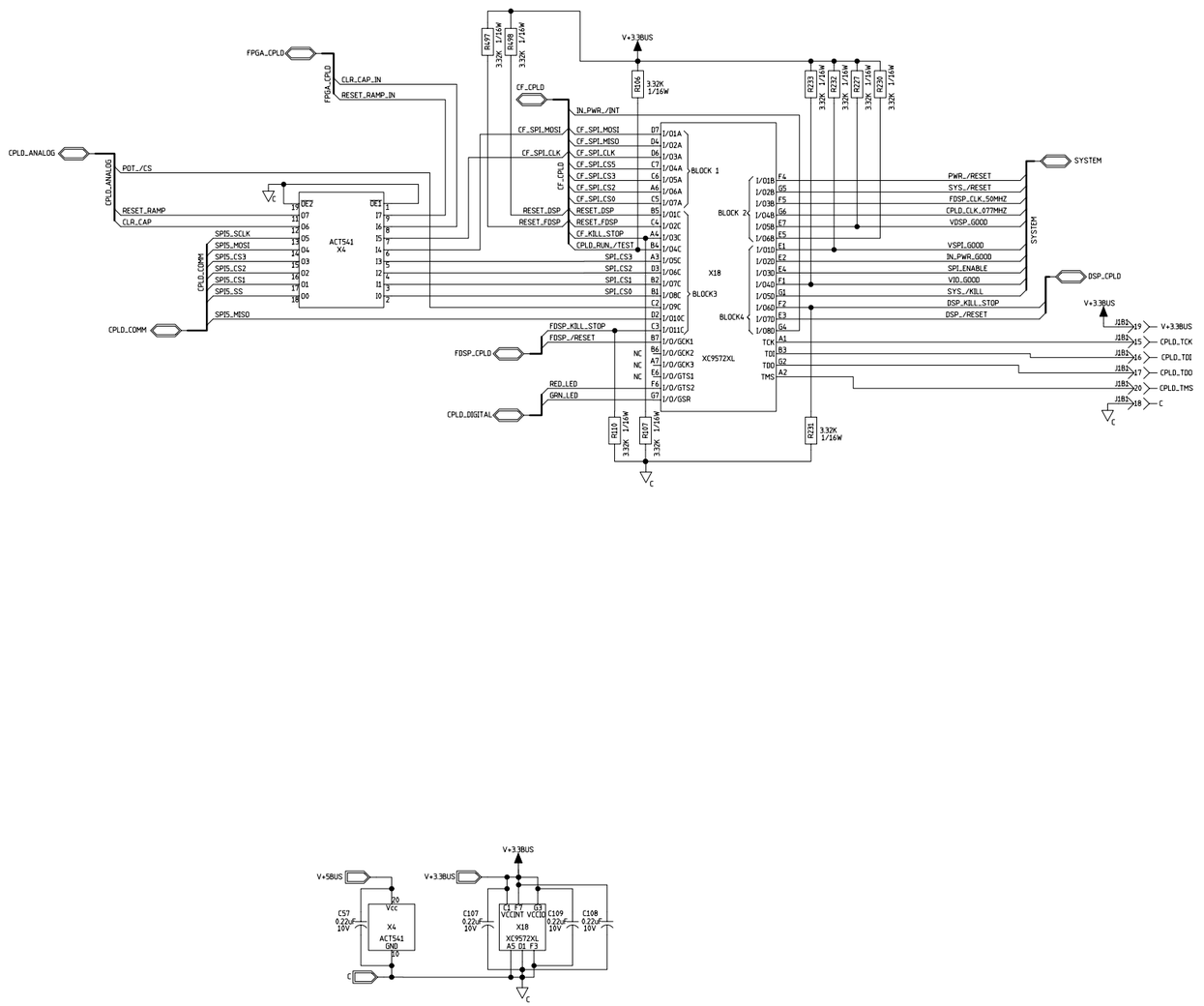
Return to Section TOC
Return to Master TOC

SCHEMATIC - CONTROL PC BOARD - G4799-3 (PAGE 5)



NOTE: This diagram is for reference only. It may not be accurate for all machines covered by this manual.

SCHEMATIC - CONTROL PC BOARD - G4799-3 (PAGE 6)



GENERAL INFORMATION

ELECTRICAL SYMBOLS PER E1537
CAPACITORS = MFD (.022/50V UNLESS OTHERWISE SPECIFIED)
RESISTORS = Ohms (1/4W UNLESS OTHERWISE SPECIFIED)
DIODES = 1A,600V (UNLESS OTHERWISE SPECIFIED)

LAST NO. USED
A- -
C- - SEE PAGE 1
D- -

LABELS
- SUPPLY VOLTAGE NET
- POWER SUPPLY SOURCE POINT
- COMMON CONNECTION
- FRAME CONNECTION
- EARTH GROUND CONNECTION

CPLD SHEET 01 OF 01

SINCE COMPONENTS OR CIRCUITRY ON A PRINTED CIRCUIT BOARD MAY CHANGE WITHOUT AFFECTING THE INTERCHANGEABILITY OF A COMPLETE BOARD, THIS DIAGRAM MAY NOT SHOW THE EXACT COMPONENTS OR CIRCUITRY OF CONTROLS HAVING A COMMON CODE NUMBER.

DESIGN INFORMATION

DRAWN BY: EF	2-5-2008	
ENGINEER: EF	REFERENCE:	
APPROVED:	---------	

EQUIPMENT TYPE: POWER WAVE

PAGE 06 OF 13

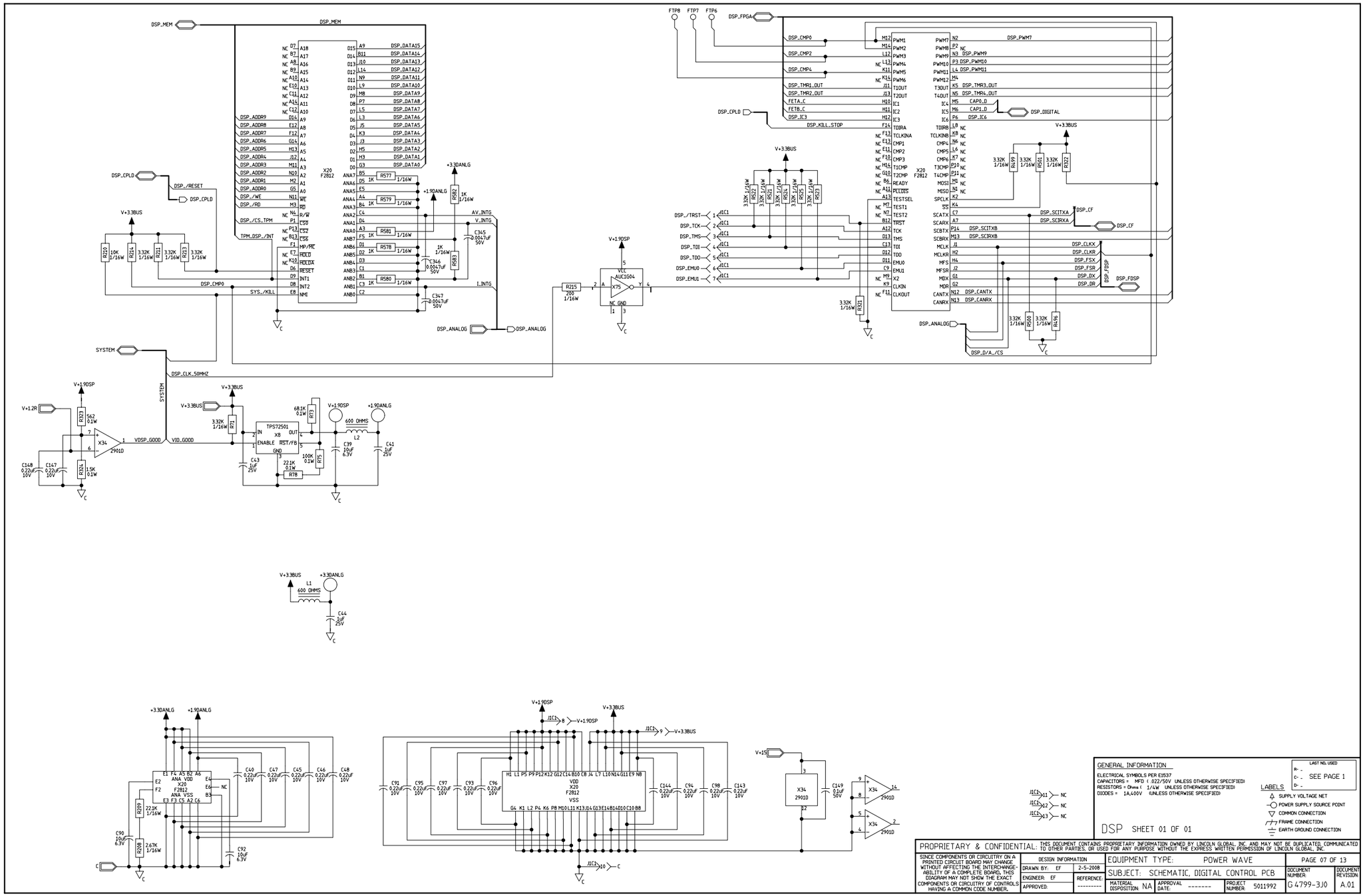
SUBJECT: SCHEMATIC, DIGITAL CONTROL PCB

MATERIAL DISPOSITION: NA	APPROVAL DATE: -------	PROJECT NUMBER: 5011992	DOCUMENT NUMBER: G 4799-3J0	DOCUMENT REVISION: A.01

NOTE: This diagram is for reference only. It may not be accurate for all machines covered by this manual.

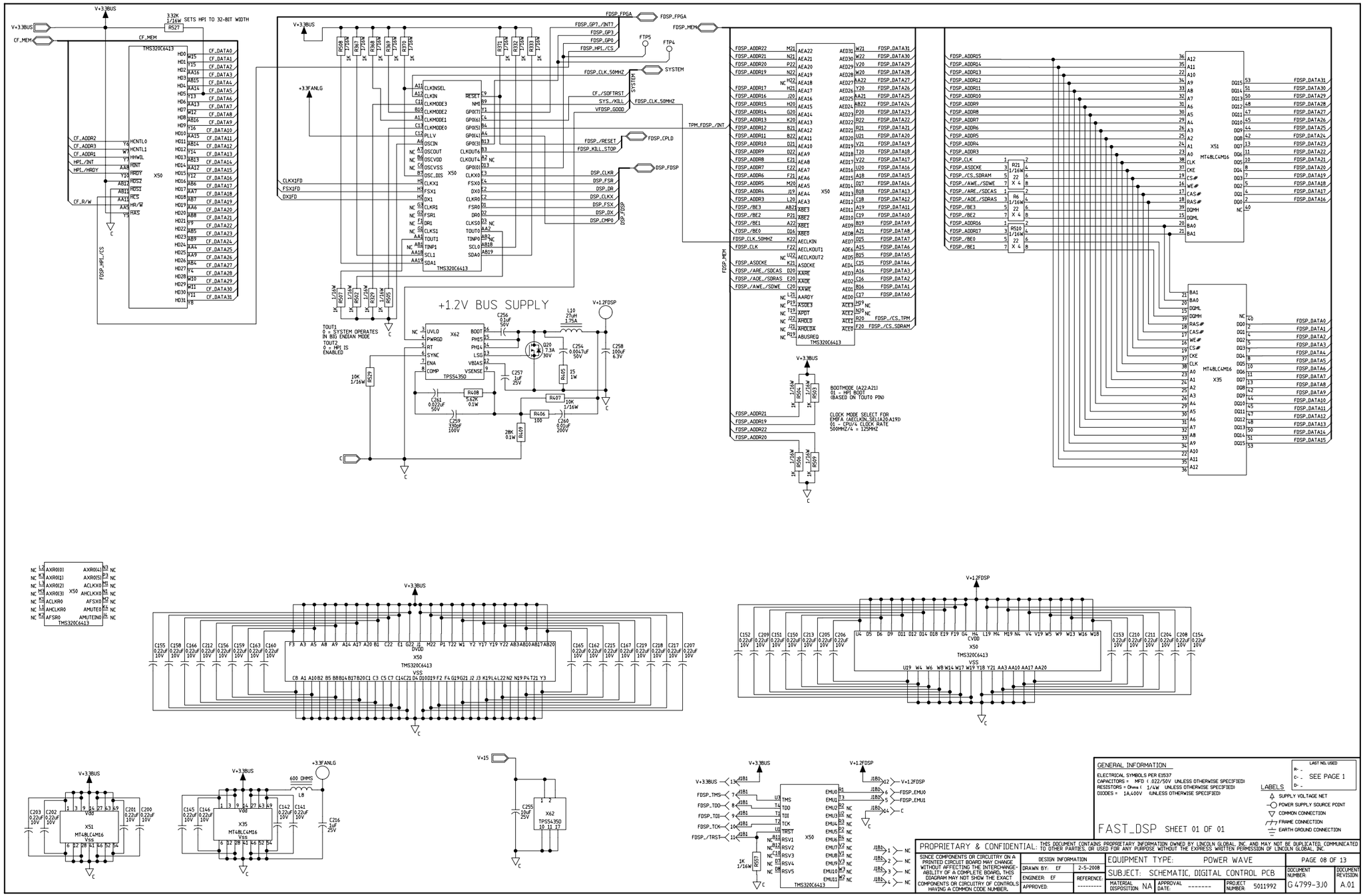
Return to Section TOC
Return to Master TOC

SCHEMATIC - CONTROL PC BOARD - G4799-3 (PAGE 7)



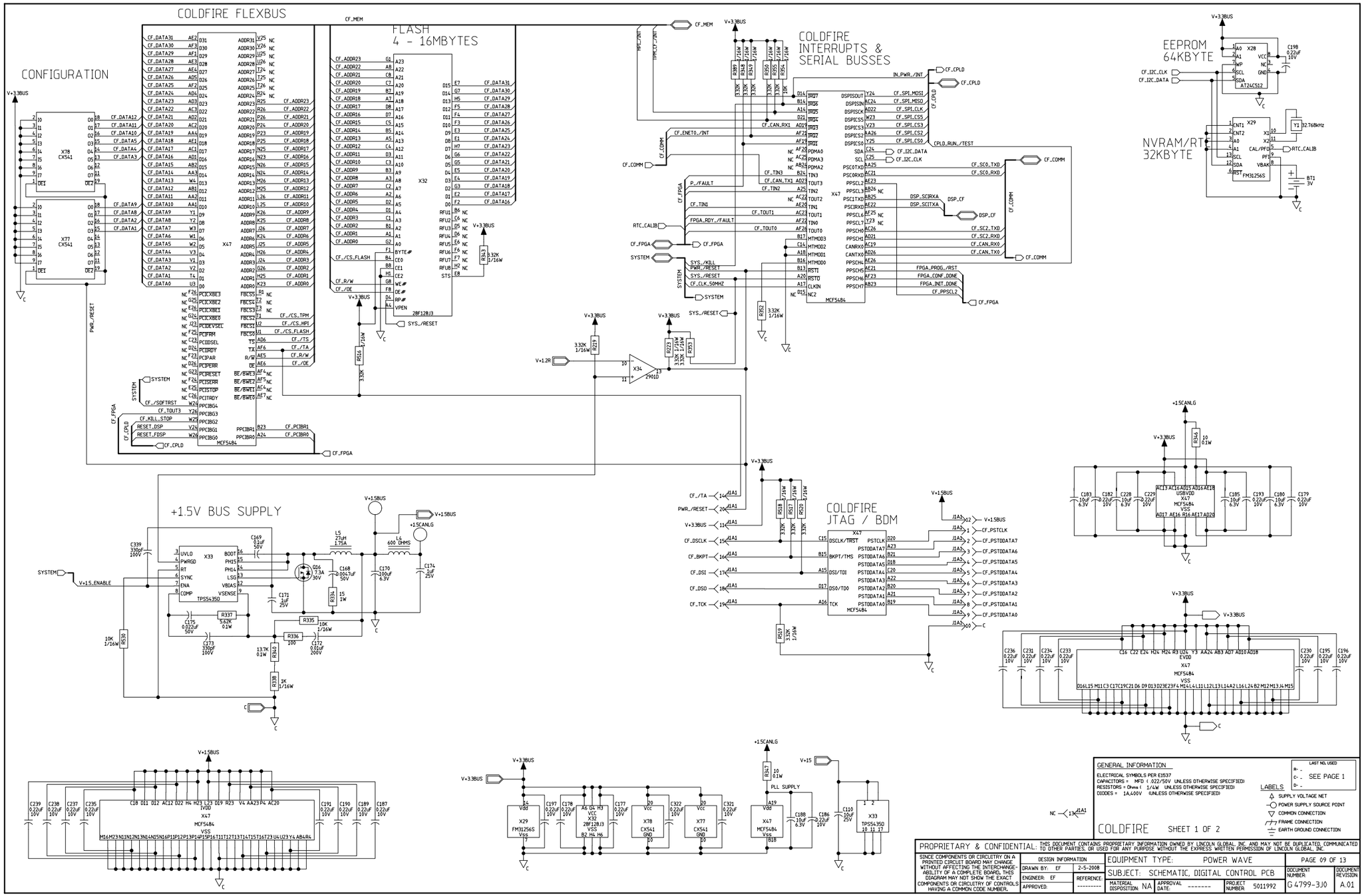
NOTE: This diagram is for reference only. It may not be accurate for all machines covered by this manual.

SCHEMATIC - CONTROL PC BOARD - G4799-3 (PAGE 8)



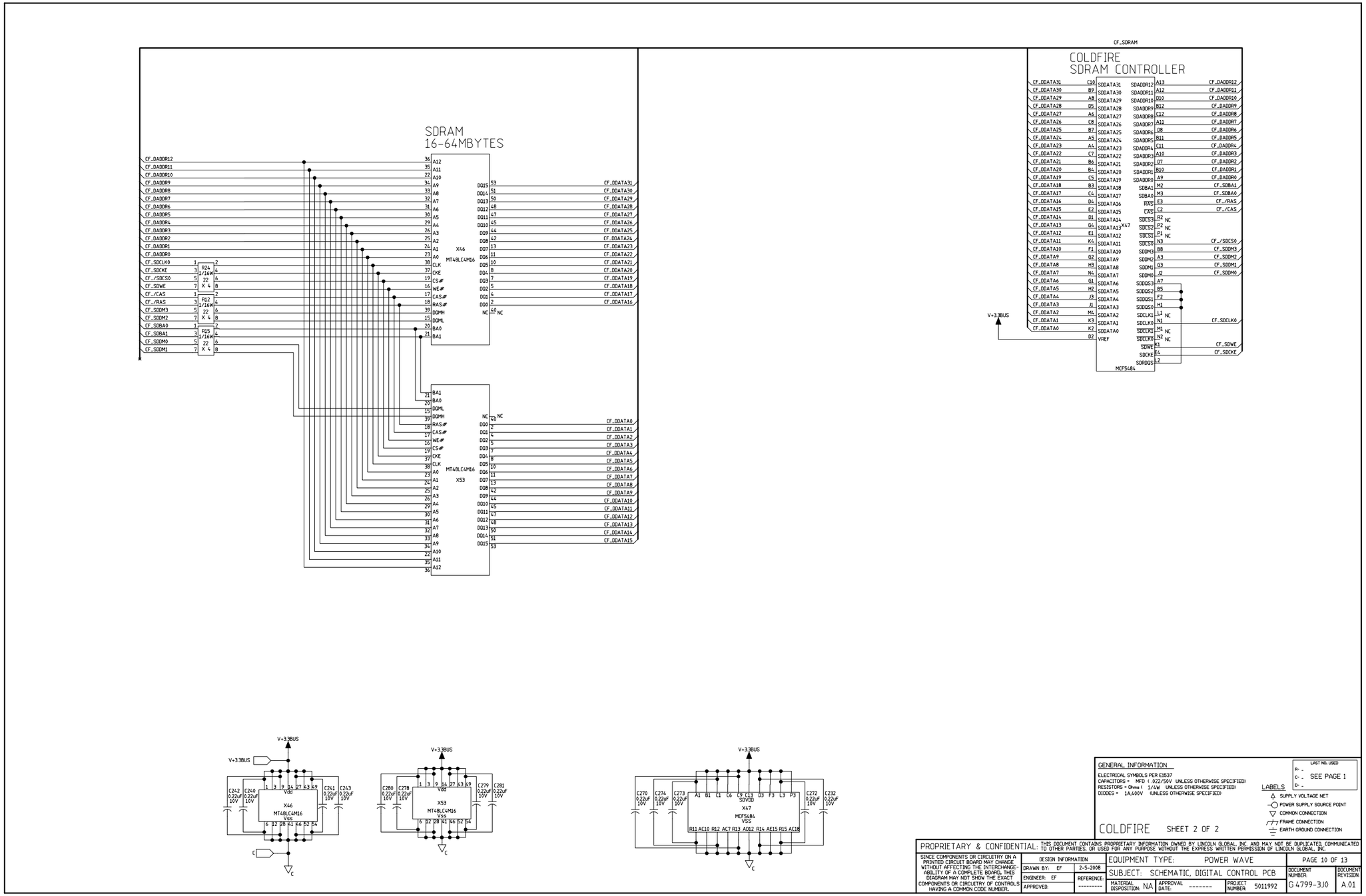
NOTE: This diagram is for reference only. It may not be accurate for all machines covered by this manual.

SCHEMATIC - CONTROL PC BOARD - G4799-3 (PAGE 9)



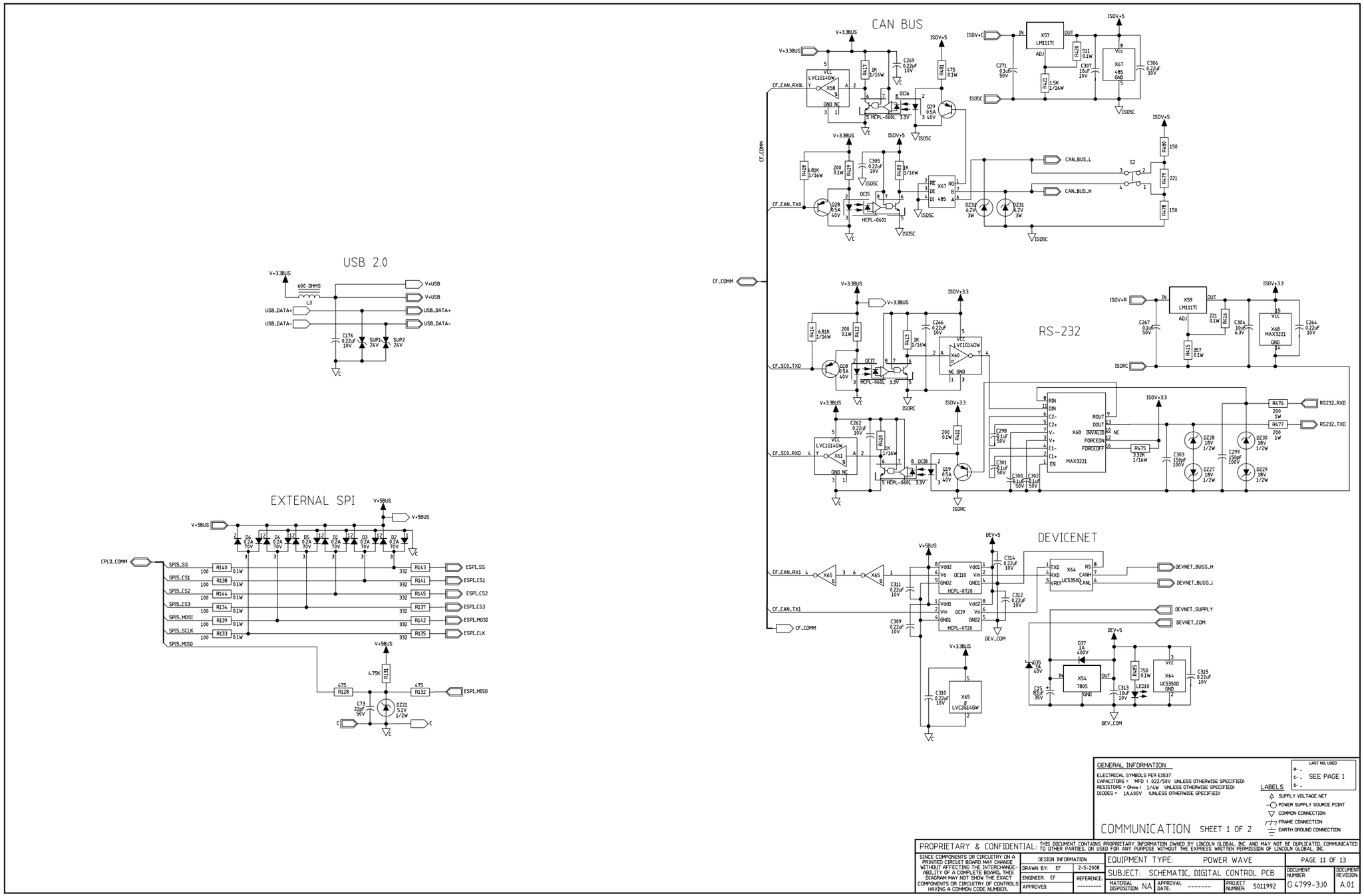
NOTE: This diagram is for reference only. It may not be accurate for all machines covered by this manual.

SCHEMATIC - CONTROL PC BOARD - G4799-3 (PAGE 10)



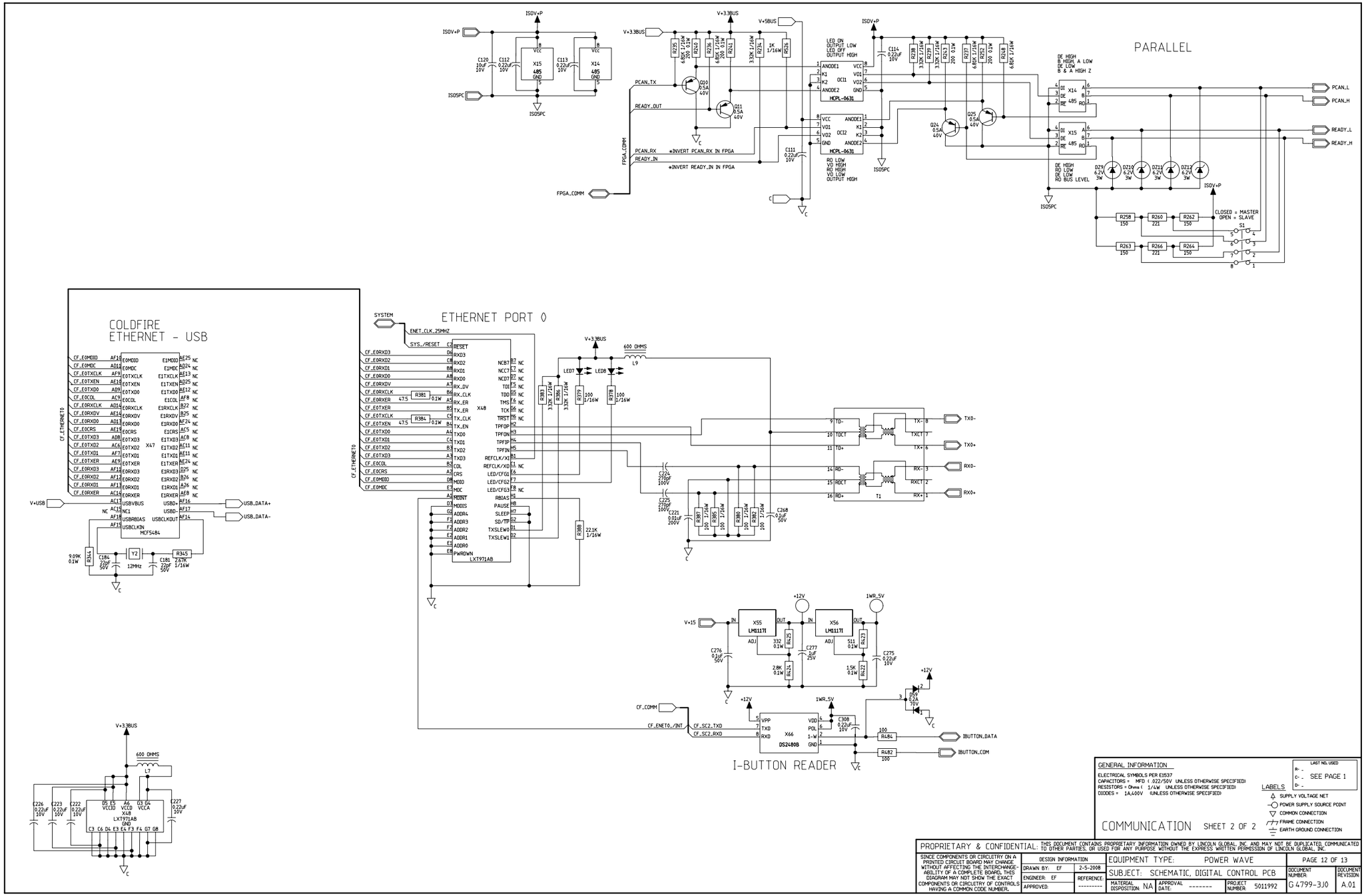
NOTE: This diagram is for reference only. It may not be accurate for all machines covered by this manual.

SCHEMATIC - CONTROL PC BOARD - G4799-3 (PAGE 11)



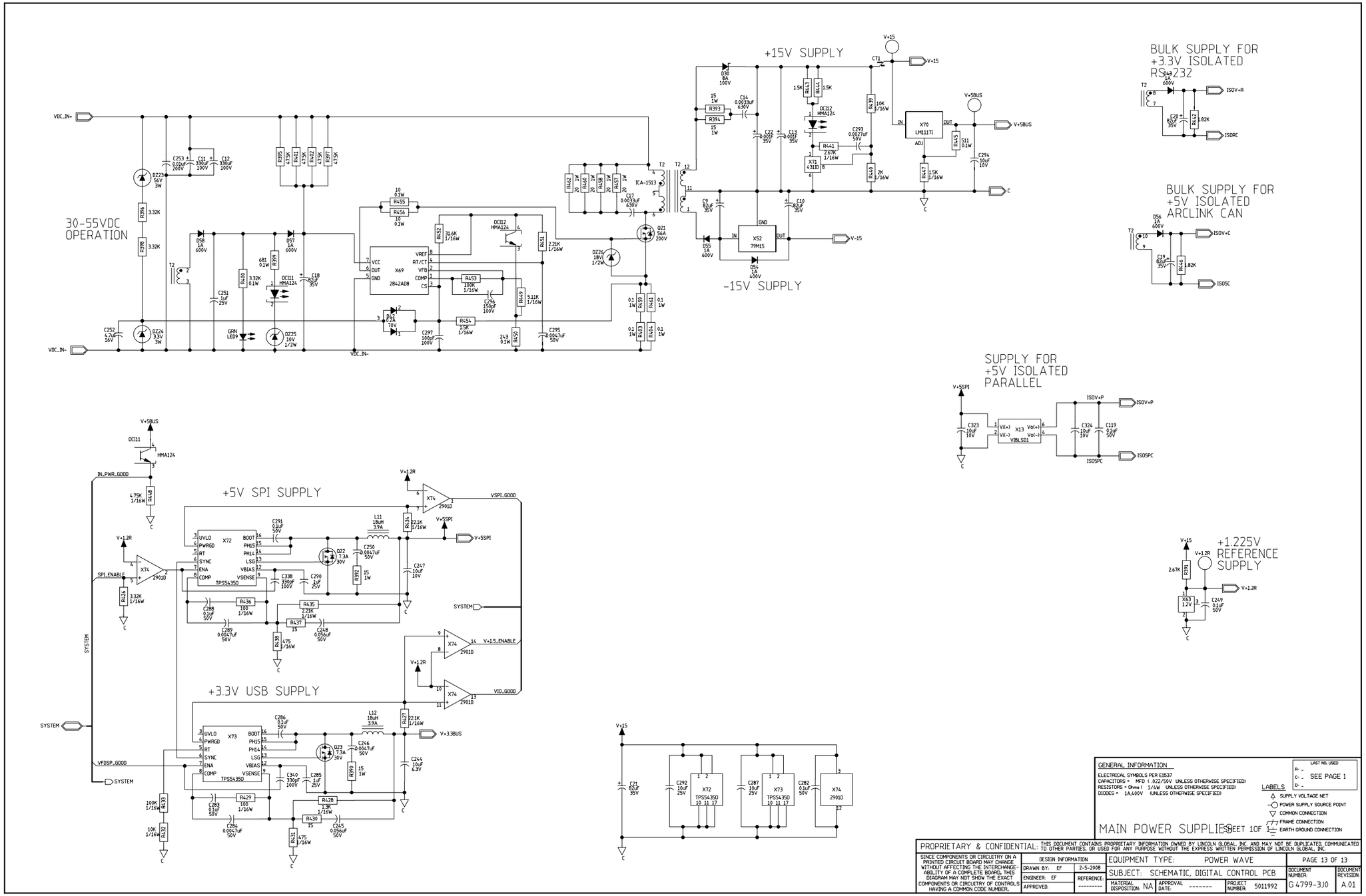
NOTE: This diagram is for reference only. It may not be accurate for all machines covered by this manual.

SCHEMATIC - CONTROL PC BOARD - G4799-3 (PAGE 12)



NOTE: This diagram is for reference only. It may not be accurate for all machines covered by this manual.

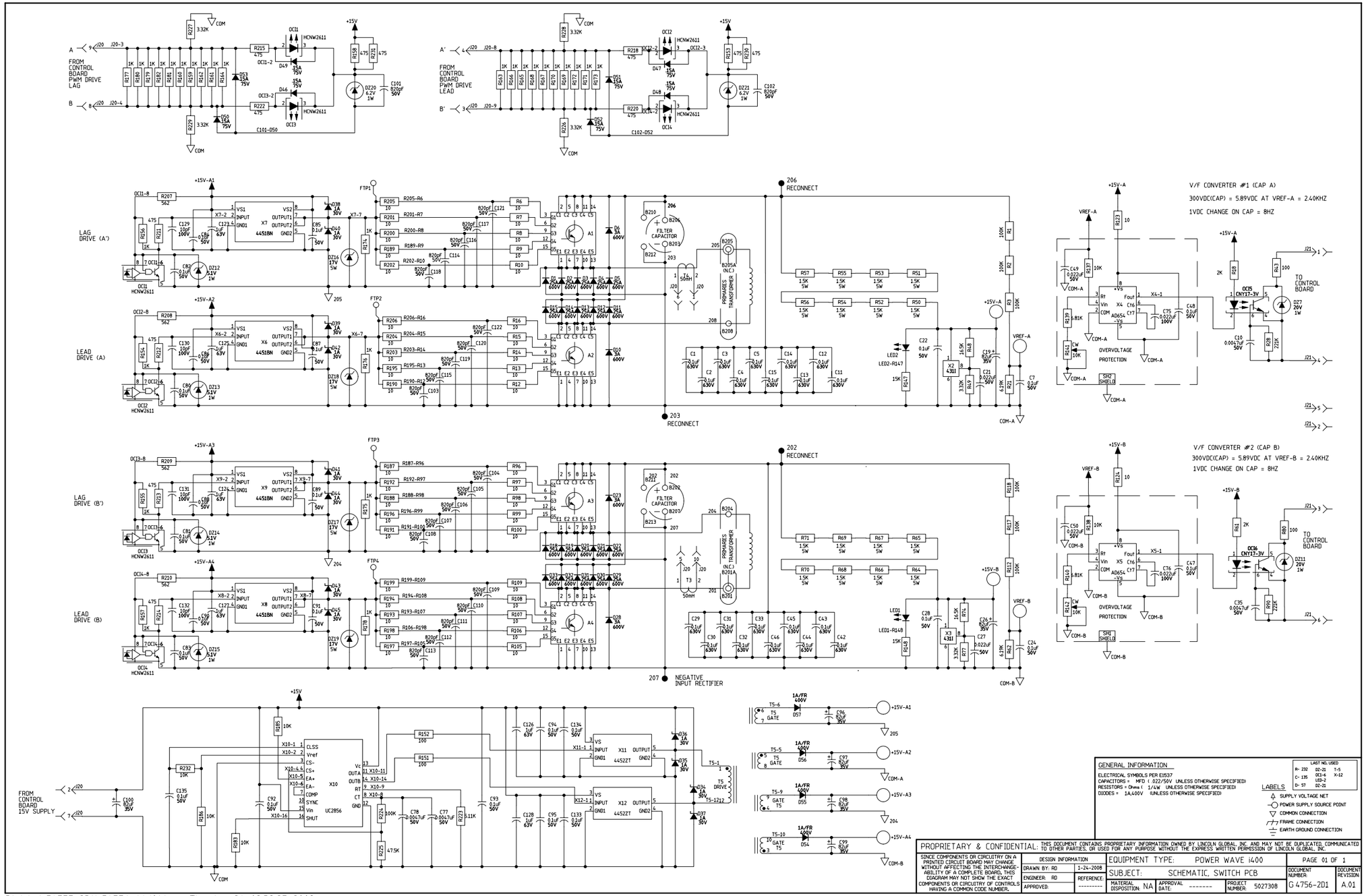
SCHEMATIC - CONTROL PC BOARD - G4799-3 (PAGE 13)



NOTE: This diagram is for reference only. It may not be accurate for all machines covered by this manual.

Return to Section TOC
Return to Master TOC

SCHEMATIC - SWITCH PC BOARD - G4756-2



C:\Jobs\G4757-2D1\G4756.sbk(01;) Thu Jan 24 08:38:27 2008

NOTE: This diagram is for reference only. It may not be accurate for all machines covered by this manual.

Return to Section TOC
Return to Master TOC

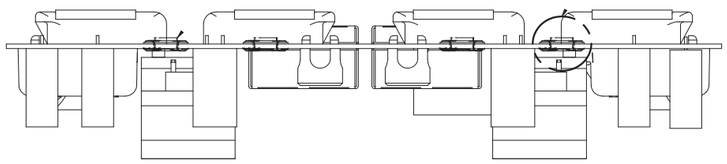
Return to Section TOC
Return to Master TOC

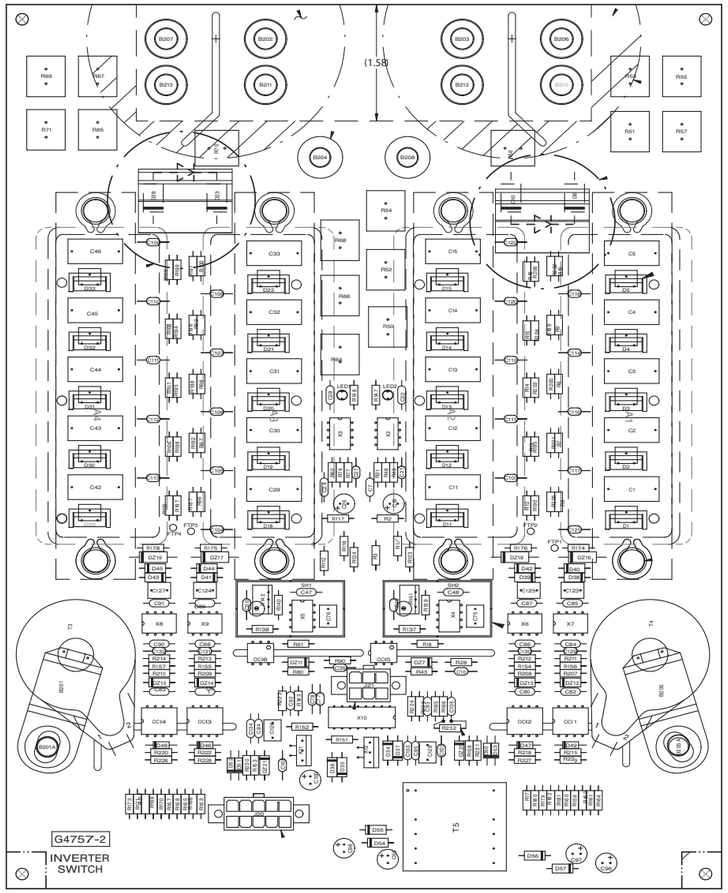
PC BOARD ASSEMBLY - SWITCH PC BOARD - G4757-2

G4757-2

ENGINEERING CONTROLLED
MANUFACTURER: No

CHANGE DETAIL: A1 THRU A4, CHANGED PART NO. AND DESCRIPTION. S19400-10R0 CHANGED QTY. ADDED S19400-2R0 WITH ALL INFO. REVISED IDENTIFICATION CODE AND SCHEMATIC NO. NOTE N.L. REVISED PART NO.





NOTES:

N.A. CAUTION THIS DEVICE IS SUBJECT TO DAMAGE BY STATIC ELECTRICITY. SEE E2454 BEFORE HANDLING.

N.B. PC BOARD AND MODULE MOUNTING HOLES TO BE FREE OF ENCAPSULANT MATERIAL FOR A CENTERED 0.50" MIN. DIA. AND 0.55" MAX. DIA. (8 HOLES). MASK PER APPROPRIATE MANUFACTURING WORK INSTRUCTIONS. TO BE CENTERED WITHIN 0.100" (DO NOT GET ON MATING SURFACES).

N.C. MOLEX CAVITIES AND AREA AROUND LOCKING TAB TO BE FREE OF ENCAPSULANT MATERIAL. MASK PER APPROPRIATE MANUFACTURING WORK INSTRUCTIONS.

N.D. FEMALE EYELET TO BE AGAINST THE OPPOSITE COMPONENT SIDE AS SHOWN. EYELET MUST NOT SPIN AFTER CLINCHING.

N.E. SOLDER EYELET SO THAT SOLDER COVERS ENTIRE EYELET AND ALL AROUND EYELET ON OPPOSITE COMPONENT SIDE ONLY. NO ICICLES OR SOLDER BLOBS PERMITTED.

N.F. BAR MUST BE FREE OF ENCAPSULATION MATERIAL ON BOTH SURFACES AROUND MOUNTING HOLES AND ENTIRE LENGTH OF MOUNTING SURFACES. ENCAPSULATION MATERIAL MUST NOT EXTEND BEYOND THE MOUNTING SURFACE PLANE (4 PLACES).

N.G. DO NOT COAT THE TOP SURFACES OR THREADS WITH ENCAPSULANT MATERIAL (4 TERMINALS). MASK PER APPROPRIATE MANUFACTURING WORK INSTRUCTIONS.

N.H. ELECTRONIC MODULES TO BE ASSEMBLED, SOLDERED, AND SEALED TO PC BOARD PER E3875.

N.J. THESE SURFACES MUST BE MAINTAINED CO -PLANAR WITHIN .010" THROUGH ENTIRE SOLDERING AND SEALING PROCESS (4 PLACES).

N.K. INSPECT POWER TERMINAL PER E1880.

N.L. ITEMS A1 THRU A4 ELECTRONIC MODULES ON THE P.C. BOARD ASSEMBLY SHALL BE MATCHED WITHIN TWO SORT CODES FOR BOTH V $_{CE}$ (1ST PAIR OF DIGITS OF 4 DIGIT SORT CODE) AND V $_{CE}$ (2ND PAIR OF DIGITS OF 4 DIGIT SORT CODE).
e.g. M1610083 X XX XXX.....
VENDOR CODE
VCE (SAT)
VGE (TH)

N.M. DO NOT COAT WITH ENCAPSULATION MATERIAL. TOP AND BOTTOM, FOR 0.80" MIN. DIA. AND 0.85" MAX. DIA. MASK PER APPROPRIATE MANUFACTURING WORK INSTRUCTIONS. TO BE CENTERED WITHIN 0.100" (DO NOT GET ON THE MATING SURFACES).

N.N. ENCAPSULATE COMPONENT SIDE OF P.C. BOARD TO A THICKNESS OF 0.125 +.0125/-.00 EXCEPT IN AREAS NOTED.

N.P. ENCAPSULATE OPPOSITE COMPONENT SIDE OF P.C. BOARD TO A THICKNESS OF .25 +.12/-00 EXCEPT IN AREAS NOTED.

N.R. ENCAPSULATION MATERIAL MUST EXTEND BEYOND EDGES OF P.C. BOARD .12 +.12/-00.

N.T. ITEM 5 MOUNTS AND SOLDERS TO SAME HOLES AS ITEM 4. ITEM 5 IS MOUNTED ON NON-COMPONENT SIDE OF P.C. BOARD.

N.U. ADDITEM 6 HEATSINK TO THESE DIODES (20 REQUIRED) DIODES MUST HAVE SAME SORT CODE (WITHIN 50 MILLIVOLTS).

N.V. SOLDER PER E-401 R232 (S194001002) TO TOP SIDE COMPONENTS AS SHOWN (R186 TO C135).

Rework Instructior

1) Install D6, D10, D23 and D29 on back side of board. Let Anode leads of D23 and D28 and Cathode leads of D6 and D10 protrude through top side of board and form to accept Diode Heatsink assemblies.

2) Install Diode Heatsink assemblies as shown. (See Detail) Remove Heatsink legs and apply E1868 (Dow 340) prior to assembly.

3) Insulate heatsink and terminals from board and surrounding components with E2581.

4) Secure entire assembly to PC. Board with E2861 RTV.

ITEM	QTY	PART NO.	DESCRIPTION
1	1	G4757-D	PC BOARD BLANK
2	8	T9147-11	CONNECTOR, EYELET POWER, FEMALE
3	430g	E2527	EPOXY ENCAPSULATING RESIN
4	2	S24869-1	PC BOARD SHIELD
5	2	S24869-2	PC BOARD SHIELD
6	20	S20590-2	HEATSINK, STAND-UP, FOR TO-220
7	20	S25253-1	HEATSINK MOUNTING CLIP
8	2	S20590-3	HEAT SINK

REFER TO ELECTRONIC COMPONENT DATABASE FOR SPECIFICATIONS ON ITEMS LISTED BELOW

	REFERENCES	QTY	PART NUMBER	DESCRIPTION
NA,N,N,L,	A1, A2, A3, A4	4	M16100-83	ELECTRONIC MODULE,5-T12704-100 IGBTS
	B201, B205	2	S24866	BRACKET,POWER-HOLDER
	B202, B203, B206, B207, B210, B211, B212, B213	8	T9147-15	CONNECTOR,EYELET,POWER,MALE
	B204, B208, B201A, B205A	4	S23006	CONNECTOR,TERMINAL,POWER
	C1, C2, C3, C4, C5, C11, C12, C13, C14, C15, C29, C30, C31, C32, C33, C42, C43, C44, C45, C46	20	S20500-17	CAPACITOR,PPMF,0.1MF,630V,5%,BOX
	C7, C22, C24, C28, C47, C48, C80, C81, C82, C83, C84, C85, C86, C87, C88, C89, C90, C91, C92, C93, C94, C95, C133, C134, C135	25	S16668-11	CAPACITOR,CEMO,0.1, 50V,10%
	C10, C35, C77, C78	4	S16668-6	CAPACITOR,CEMO,4700pF,50V,10%
	C19, C26, C96, C97, C98, C99, C100	7	S13490-197	CAPACITOR,ALEL,82.35V,20%,LOW-ESR
	C21, C27, C49, C50	4	S16668-5	CAPACITOR,CEMO,.022,50V,20%
	C75, C76	2	S20500-14	CAPACITOR,PPMF,.022,100V,BOX5%
	C101, C102, C103, C104, C105, C106, C107, C108, C109, C110, C111, C112, C113, C114, C115, C116, C117, C118, C119, C120, C121, C122	22	S16668-7	CAPACITOR,CEMO,820pF,50V,5%
	C123, C124, C125, C126, C127, C128	6	S13490-173	CAPACITOR,PEMF,1.0,63V,10%
	C129, C130, C131, C132	4	S16668-13	CAPACITOR,CEMO,10pF,100V,10%
	D1, D2, D3, D4, D5, D11, D12, D13, D14, D15, D18, D19, D20, D21, D22, D29, D30, D31, D32, D33	20	T12705-53	DIODE, TO220, 25A, 600V
	D6, D10, D23, D28	4	T12705-59	DIODE,AXLDS,3A,600V,UFR
N.U.	D34, D35, D36, D37, D38, D39, D40, D41, D42, D43, D44, D45	12	T12705-23	DIODE,SCHOTTKY,AXLDS,1A,30V,1N5818
	D46, D47, D48, D49, D50, D51, D52, D53	8	T12705-22	DIODE,AXLDS,0.15A,75V,1N914
	D54, D55, D56, D57	4	T12705-34	DIODE,AXLDS,1A,400V,FR,1N4936
	D58, D59	2	T12705-61	DIODE,TO247,70A,600V,ULTRA-FAST
	DZ7, DZ11	2	T12702-4	ZENER DIODE,1W,20V,5%,1N4747A
	DZ12, DZ13, DZ14, DZ15	4	T12702-52	ZENER DIODE,1W,5.1V,5%,1N4733A
	DZ16, DZ17, DZ18, DZ19	4	T12702-50	ZENER DIODE,5W,17V,5%,1N5354B
	DZ20, DZ21	2	T12702-40	ZENER DIODE,1W,6.2V,5%,1N4735A
	J20	1	S24020-10	CONNECTOR,MOLEX,MINI,PCB,10-PIN,TIN
	J21	1	S24020-6	CONNECTOR,MOLEX,MINI,PCB,6-PIN,TIN
	LED1, LED2	2	T13657-6	LED,T-1,RED,HLMP-K101
	OC1, OC2, OC3, OC4	4	S15000-38	OPTOCOUPLER,TTL-OUT,HI-SPD,HI-CMR,2611
	OC5, OC6	2	S15000-22	OPTOCOUPLER,PHOTO-Q,70V,CNY17-3/VDE
	R1, R2, R3, R112, R117, R118, R224	7	S19400-1003	RESISTOR,MF,1/4W,100K,1%
	R6, R7, R8, R9, R10, R12, R13, R14, R15, R16, R96, R97, R98, R99, R100, R105, R106, R107, R108, R109, R187, R188, R189, R190, R191, R192, R193, R194, R195, R196, R197, R198, R199, R200, R201, R202, R203, R204, R205, R206	40	S19400-2R00	RESISTOR,MF,1/4W,2.00,1%
	R18, R61	2	S19400-2001	RESISTOR,MF,1/4W,2.00K,1%
	R21, R62	2	S19400-6191	RESISTOR,MF,1/4W,6.19K,1%
	R28, R90	2	S19400-2213	RESISTOR,MF,1/4W,221K,1%
	R43, R80, R151, R152	4	S19400-1000	RESISTOR,MF,1/4W,100,1%
	R48, R74	2	S19400-1652	RESISTOR,MF,1/4W,16.5K,1%
	R49, R77, R226, R227, R228, R229	6	S19400-3321	RESISTOR,MF,1/4W,3.32K,1%
	R50, R51, R52, R53, R54, R55, R56, R57, R64, R65, R66, R67, R68, R69, R70, R71	16	S25923-1501	RESISTOR,STAND-UP,MF,5W,1.50K,5%
	R123, R124	2	S19400-10R0	RESISTOR,MF,1/4W,10.0,1%
N,V	R137, R138, R183, R185, R186, R232	6	S19400-1002	RESISTOR,MF,1/4W,10.0K,1%
	R139, R140	2	S19403-6811	RESISTOR,MF,1/4W,6.81K,1%
	R141, R142	2	S16296-5	TRIMMER,MT,1/2W,10K, 10%,LINEAR
	R147, R148	2	S19400-1502	RESISTOR,MF,1/4W,15.0K,1%
	R153, R158, R211, R212, R213, R214, R215, R218, R220, R222, R230, R231	12	S19400-4750	RESISTOR,MF,1/4W,475,1%
	R154, R155, R156, R157, R159, R160, R161, R162, R163, R164, R165, R166, R167, R168, R169, R170, R171, R172, R173, R174, R175, R176, R177, R178, R179, R180, R181, R182	28	S19400-1001	RESISTOR,MF,1/4W,1.00K,1%
	R207, R208, R209, R210	4	S19400-5620	RESISTOR,MF,1/4W,.562,1%
	R223	1	S19400-5111	RESISTOR,MF,1/4W,5.11K,1%
	R225	1	S19400-4752	RESISTOR,MF,1/4W,47.5K,.1%
	SH1, SH2	2	S24869-1	PC BOARD SHIELD,0.75 X 1.35
	T3, T4	2	M19612	CURRENT-TRANSDUCER,125-TURN
	T5	1	S13000-96	TRANSFORMER,GATE-DRIVE,PCB,AF3472
	X2, X3	2	S15128-10	VOLTAGE REF,ADJ, PRECISION,431I
	X4, X5	2	M13552-3	IC,CONVERTER,V/F,654
	X6, X7, X8, X9	4	S15018-21	IC,CMOS,DRIVER,MOSFET,1.44S1(SS)
	X10	1	M15458-7	IC, PWM CONTROLLER, 1MODE, 2856,IC16
	X11, X12	2	S15018-32	IC,CMOS,DRIVER,MOSFET,TO220/5,MIC4452ZT(SS)

CAPACITORS = MFD/VOLTS
RESISTORS = OHMS

REVISION CONTROL
G4757-2D3
PART NO. IDENTIFICATION CODE
TEST PER E4338-SW
COAT WITH E1844 AND E3668
SCHEMATIC REFERENCE: G4756-2D3
POT PER E1911-E
COPPER WEIGHT: OUTER LAYERS 4.0 oz/sq. ft.
INNER LAYERS 2.0 oz/sq. ft.

MAKE DETAIL
MANUFACTURE PER E1911
BUY BLANK COMPLETE
(2 BOARDS PER PANEL)
4 LAYER BOARD BLANK PANEL
SEE ELECTRONIC FILE FOR ADDITIONAL INFORMATION.

FOR PARTS ORDERS INCLUDE:
S25191-2PRINT
(4) T12837THERMAL COMPOUND

MANUFACTURING TOLERANCE PER E3856 UNLESS OTHERWISE SPECIFIED TOLERANCE FOR DECIMALS ± .03 in. (± 0.5 mm) ON PLACE DECIMALS ± .010 in. (± 0.25 mm) ON ALL ANGLES ± .5 OF A DEGREE ON MATERIAL TOLERANCE IT'S TO AGREE WITH PUBLISHED STANDARDS.
DO NOT SCALE THIS DRAWING

CONTROL: CLEVELAND
DRAWN BY: jbarto
ENGINEER: Rob Dallge
APPROVED: -

SCALE: 1:1 IF PRINTED @ A1 SIZE
UNITS: INCH

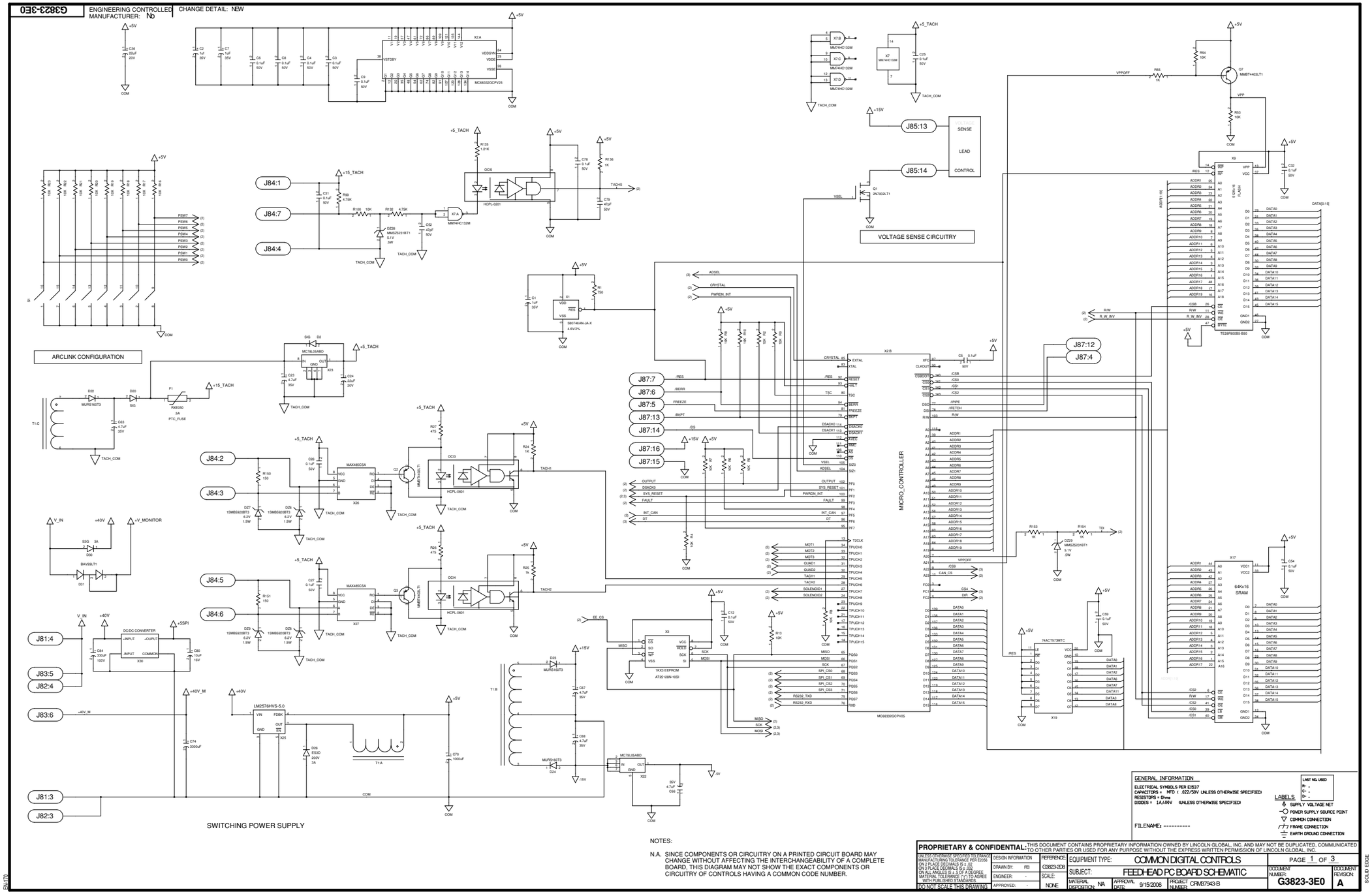
EQUIPMENT TYPE: INTEGRATED CABINET
SUBJECT: SWITCH P.C BOARD ASSEMBLY
MATERIAL DISPOSITION: NA
APPROVAL DATE: 5-2-2008
PROJECT NUMBER: CRM35661-A
REFERENCE: G4757-1

PAGE 1 OF 1
DOCUMENT NUMBER: G4757-2
DOCUMENT REVISION: C

SIZE A3 EDGE
Insight

EM-170

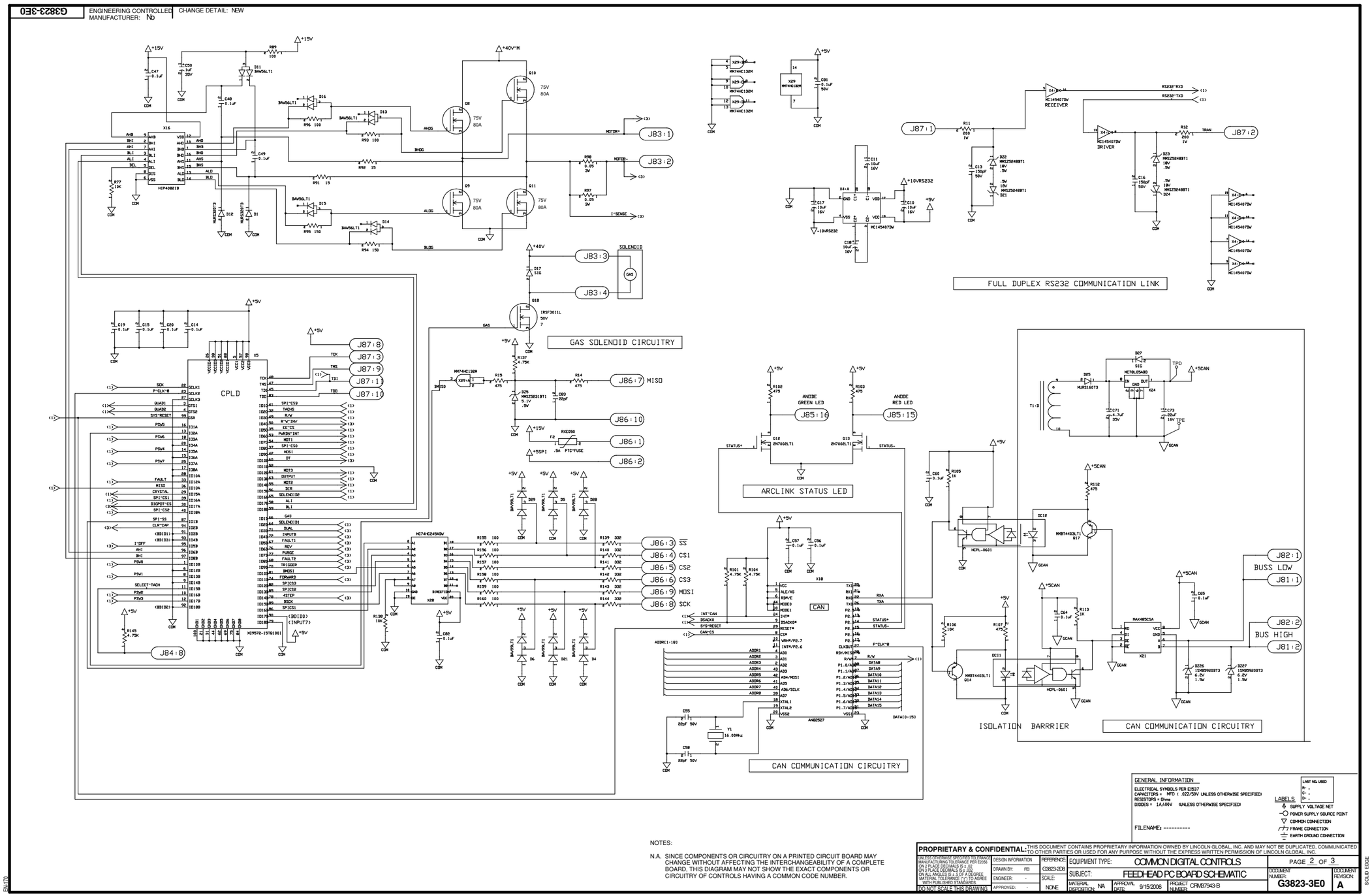
SCHEMATIC - FEED HEAD PC BOARD - G3823-3 (PAGE 1)



NOTE: This diagram is for reference only. It may not be accurate for all machines covered by this manual.

Return to Section TOC
Return to Master TOC

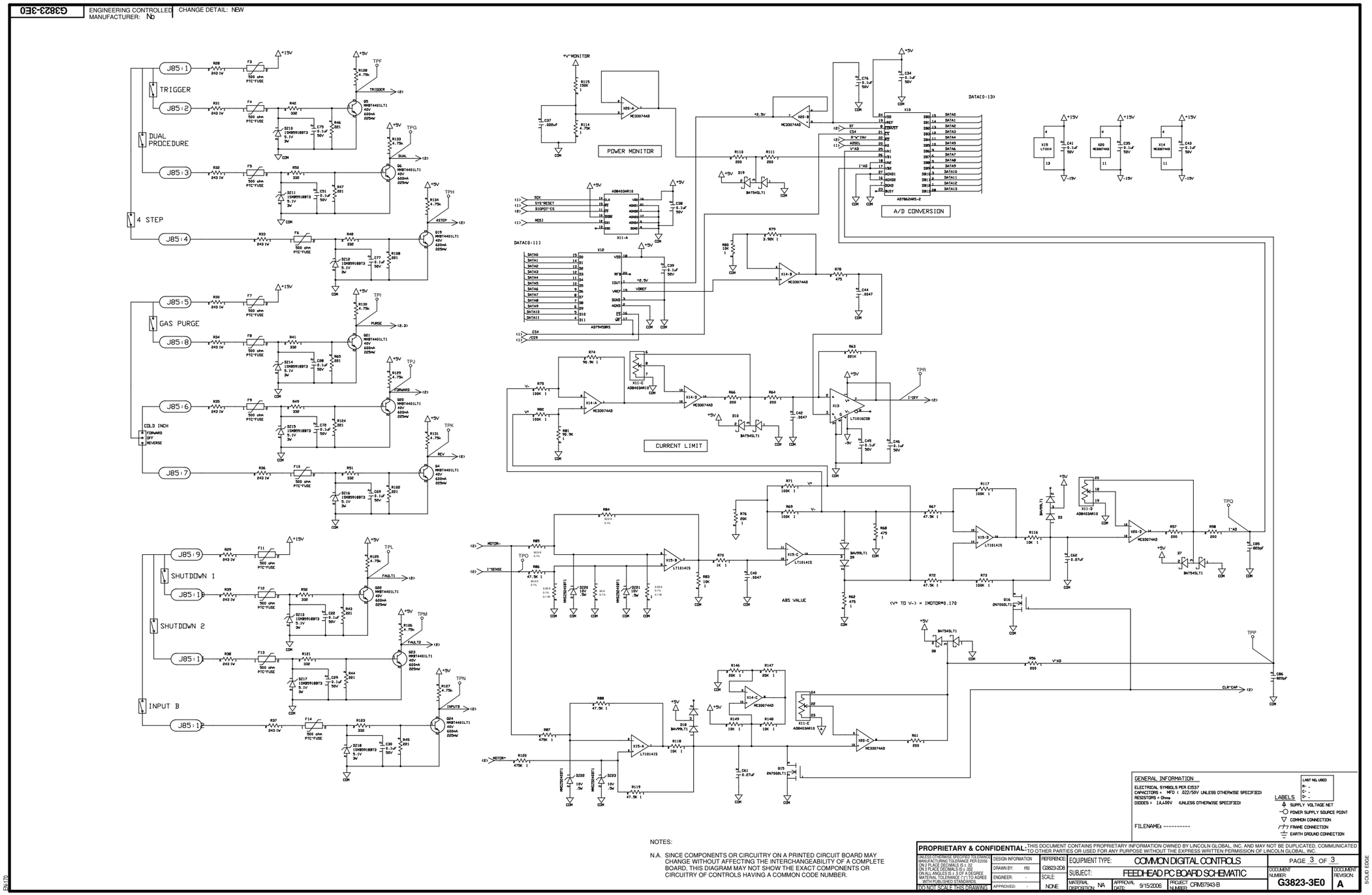
SCHEMATIC - FEED HEAD PC BOARD - G3823-3 (PAGE 2)



NOTE: This diagram is for reference only. It may not be accurate for all machines covered by this manual.

Return to Section TOC
Return to Master TOC

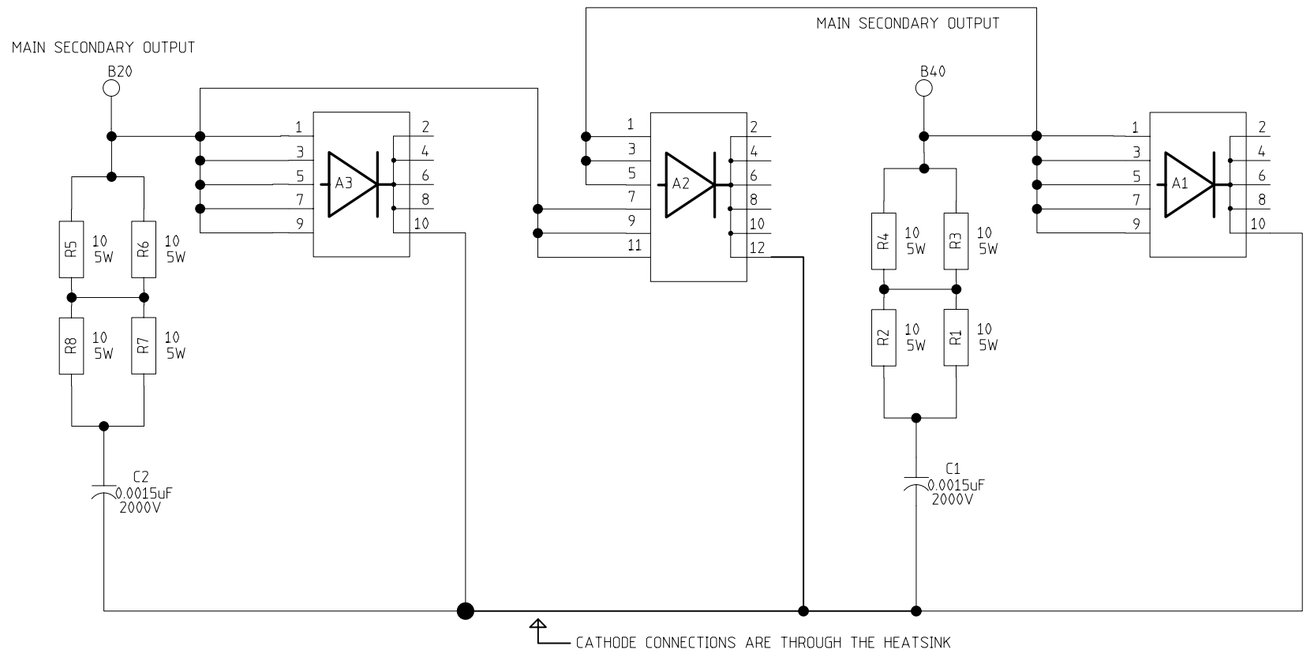
SCHEMATIC - FEED HEAD PC BOARD - G3823-3 (PAGE 3)



NOTE: This diagram is for reference only. It may not be accurate for all machines covered by this manual.

Return to Section TOC
Return to Master TOC

SCHEMATIC - OUTPUT RECTIFIER PC BOARD - (M21132-1)



GENERAL INFORMATION

ELECTRICAL SYMBOLS PER E1537
CAPACITORS = MFD (.022/50V UNLESS OTHERWISE SPECIFIED)
RESISTORS = Ohms (1/4W UNLESS OTHERWISE SPECIFIED)
DIODES = 1A,400V (UNLESS OTHERWISE SPECIFIED)

LAST NO. USED
R- 8 A- 3
C- 4
D- -

LABELS
- SUPPLY VOLTAGE NET
- POWER SUPPLY SOURCE POINT
- COMMON CONNECTION
- FRAME CONNECTION
- EARTH GROUND CONNECTION

SINCE COMPONENTS OR CIRCUITRY ON A PRINTED CIRCUIT BOARD MAY CHANGE WITHOUT AFFECTING THE INTERCHANGE-ABILITY OF A COMPLETE BOARD, THIS DIAGRAM MAY NOT SHOW THE EXACT COMPONENTS OR CIRCUITRY OF CONTROLS HAVING A COMMON CODE NUMBER.

DESIGN INFORMATION		
DRAWN BY: TS	11-19-2007	REFERENCE: ---------
ENGINEER: TS		
APPROVED:		

EQUIPMENT TYPE: INTEGRA 350				PAGE 01 OF 01
SUBJECT: SCHEMATIC, OUTPUT RECTIFIER PCB			DOCUMENT NUMBER: M21132-1A1	DOCUMENT REVISION: A.01
MATERIAL DISPOSITION: NA	APPROVAL DATE: --------	PROJECT NUMBER: 5028540		

C:\Jobs\M21133-1A1\M21132.sbk(01;) Mon Nov 19 13:04:12 2007

NOTE: This diagram is for reference only. It may not be accurate for all machines covered by this manual.